

HANDBOOK OF THE BIRDS OF THE WORLD

Volume 2

New World
Vultures
to
Guineafowl



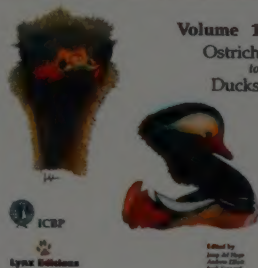

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Andrew Elliott
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HANDBOOK OF THE BIRDS OF THE WORLD

Volume 1
Ostrich
to
Ducks



BIRDWATCH
BIRD BOOK OF THE
YEAR 1992

REVIEWS OF VOLUME 1

I judge this major work to be the single most useful reference on birds of the world.

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The editors, contributors and artists can be truly proud of the monumental achievement this volume represents.

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There is no book on birds anywhere like this one...The book is superbly researched, formatted and produced.

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The Handbook should be everyone's first choice for a modern, comprehensive reference on the birds of the world.

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Perhaps the most ambitious Handbook ever to have used this superlative.

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If perfection does not exist upon Earth, this first volume comes very close to it.

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The authors have done very well and have obviously kept as up to date as practicable on new information as it has come to hand.

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We await the subsequent volumes with impatience.

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I applaud the combination of readable prose, extensive use of the scientific literature and beautiful, high-quality illustrative materials.

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HANDBOOK OF THE BIRDS OF THE WORLD

Volume 2

New World Vultures *to* Guineafowl



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HANDBOOK OF THE BIRDS OF THE WORLD

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New World Vultures to Guineafowl

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*A Dolors, Isabel i Zeta, la comprensió i suport de les quals
ha estat vital per tirar endavant aquest projecte.*

*To Dolors, Isabel and Zeta, whose understanding and support
has been vital in helping this project on its way.*

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JO – J. Orta

CMW – C. M. White

ACCIPITRIDAE

1 *ACK*; 2 *ACK*; 3 *WSC*; 4 *SJSD*; 5 *WSC*; 6 *ROB*; 7 *ROB*; 8 *ROB*; 9 *SJSD*; 10 *SJSD*; 11 *JO*; 12 *JO*; 13 *WSC*; 14 *SJSD*; 15 *SJSD*; 16 *ROB*; 17 *ACK*; 18 *ROB*; 19 *ACK*; 20 *SJSD*; 21 *ROB*; 22 *SJSD*; 23 *ACK*; 24 *ROB*; 25 *ROB*; 26 *ROB*; 27 *ROB*; 28 *CMW*; 29 *ROB*; 30 *JO*; 31 *JO*; 32 *SJSD*; 33 *SJSD*; 34 *SJSD*; 35 *SJSD*; 36 *ACK*; 37 *ACK*; 38 *JO*; 39 *JO*; 40 *CMW*; 41 *BM*; 42 *WSC*; 43 *WSC*; 44 *ACK*; 45 *JO*; 46 *JO*; 47 *ACK*; 48 *ACK*; 49 *WSC*; 50 *WSC*; 51 *ACK*; 52 *WSC*; 53 *JO*; 54 *ACK*; 55 *BM*; 56 *ACK*; 57 *ACK*; 58 *WSC*; 59 *JO*; 60 *ACK*; 61 *ACK*; 62 *ACK*; 63 *ACK*; 64 *ACK*; 65 *ACK*; 66 *WSC*; 67 *WSC*; 68 *WSC*; 69 *WSC*; 70 *WSC*; 71 *WSC*; 72 *ACK*; 73 *ACK*; 74 *JO*; 75 *ACK*; 76 *JO*; 77 *SJSD*; 78 *ACK*; 79 *ROB*; 80 *SJSD*; 81 *ACK*; 82 *JO*; 83 *ROB*; 84 *JO*; 85 *JO*; 86 *JO*; 87 *ACK*; 88 *ACK*; 89 *ACK*; 90 *ACK*; 91 *ACK*; 92 *ACK*; 93 *ACK*; 94 *ROB*; 95 *WSC*; 96 *WSC*; 97 *ACK*; 98 *ACK*; 99 *ACK*; 100 *ACK*; 101 *WSC*; 102 *JO*; 103 *JO*; 104 *ACK*; 105 *WSC*; 106 *SJSD*; 107 *SJSD*; 108 *SJSD*; 109 *SJSD*; 110 *SJSD*; 111 *SJSD*; 112 *WSC*; 113 *SJSD*; 114 *SJSD*; 115 *SJSD*; 116 *SJSD*; 117 *ROB*; 118 *ROB*; 119 *ACK*; 120 *ACK*; 121 *JO*; 122 *WSC*; 123 *WSC*; 124 *WSC*; 125 *SJSD*; 126 *SJSD*; 127 *WSC*; 128 *ACK*; 129 *ACK*; 130 *JO*; 131 *ACK*; 132 *CMW*; 133 *ROB*; 134 *ROB*; 135 *ROB*; 136 *CMW*; 137 *ROB*; 138 *ROB*; 139 *ROB*; 140 *ACK*; 141 *ACK*; 142 *JO*; 143 *SJSD*; 144 *SJSD*; 145 *SJSD*; 146 *SJSD*; 147 *ACK*; 148 *ACK*; 149 *WSC*; 150 *WSC*; 151 *JO*; 152 *ROB*; 153 *ROB*; 154 *ROB*; 155 *ROB*; 156 *ROB*; 157 *ROB*; 158 *ROB*; 159 *ROB*; 160 *ROB*; 161 *ROB*; 162 *ROB*; 163 *ROB*; 164 *ROB*; 165 *ROB*; 166 *ROB*; 167 *ROB*; 168 *ROB*; 169 *ROB*; 170 *ROB*; 171 *ROB*; 172 *ROB*; 173 *ROB*; 174 *ROB*; 175 *CMW*; 176 *ROB*; 177 *CMW*; 178 *ROB*; 179 *ROB*; 180 *ROB*; 181 *CMW*; 182 *ROB*; 183 *ROB*; 184 *ROB*; 185 *ROB*; 186 *ROB*; 187 *CMW*; 188 *CMW*; 189 *ROB*; 190 *JO*; 191 *ACK*; 192 *ACK*; 193 *JO*; 194 *JO*; 195 *CMW*; 196 *JO*; 197 *ACK*; 198 *ACK*; 199 *ACK*; 200 *ACK*; 201 *ROB*; 202 *ROB*; 203 *SJSD*; 204 *WSC*; 205 *WSC*; 206 *BM*; 207 *BM*; 208 *ACK*; 209 *BM*; 210 *BM*; 211 *BM*; 212 *ACK*; 213 *SJSD*; 214 *JO*; 215 *SJSD*; 216 *ACK*; 217 *JO*; 218 *ACK*; 219 *JO*; 220 *SJSD*; 221 *ACK*; 222 *WSC*; 223 *ACK*; 224 *ROB*; 225 *ACK*; 226 *ACK*; 227 *WSC*; 228 *WSC*; 229 *WSC*; 230 *WSC*; 231 *WSC*; 232 *WSC*; 233 *WSC*; 234 *ROB*; 235 *ROB*; 236 *ACK*; 237 *ROB*.

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1 *ROB*; 2 *ROB*; 3 *ROB*; 4 *ROB*; 5 *ROB*; 6 *ROB*; 7 *ROB*; 8 *ROB*; 9 *ROB*; 10 *ROB*; 11 *ROB*; 12 *ROB*; 13 *ROB*; 14 *ROB*; 15 *ROB*; 16 *ROB*; 17 *ROB*; 18 *ACK*; 19 *WSC*; 20 *WSC*; 21 *WSC*; 22 *WSC*; 23 *WSC*; 24 *WSC*; 25 *JO*; 26 *JO*; 27 *ACK*; 28 *ACK*; 29 *ACK*; 30 *WSC*; 31 *SJSD*; 32 *CMW*; 33 *ACK*; 34 *ACK*; 35 *ACK*; 36 *ACK*; 37 *ACK*; 38 *ACK*; 39 *JO*; 40 *JO*; 41 *JO*; 42 *JO*; 43 *ROB*; 44 *CMW*; 45 *ROB*; 46 *ROB*; 47 *JO*; 48 *ACK*; 49 *WSC*; 50 *SJSD*; 51 *SJSD*; 52 *SJSD*; 53 *SJSD*; 54 *SJSD*; 55 *ACK*; 56 *WSC*; 57 *JO*; 58 *CMW*; 59 *CMW*; 60 *CMW*; 61 *ACK*.

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Foreword

Communication, or the exchange of information, is the cornerstone of sociality regardless of the species, its social structure and the nature of the information being exchanged. All types of information are exchanged, from simple expressions of the feelings and intents of individual animals, to complex hypotheses about the world around us. Most critical in the development of social organisms is the acquisition of communication abilities, both within and between species. These abilities involve sending proper signals and their correct receiving and interpretation. Humans, as social animals, must exchange information with one another and therefore must acquire the needed abilities to achieve this communication. Information held in isolation by a single person is quickly lost, and, indeed, may be considered as knowledge never gained. As individual humans learn new information about the world around them, they continually pass this knowledge on to others before it is lost. In science, as in other human endeavours, much attention is given to methods by which new knowledge is learned. Equally important are the methods by which this information is conveyed to other persons. Efficiency of communication is decisive. As the information becomes ever more complex and abundant, the organization of its communication is ever more critical. Included in this organization is the cost and time involved in the exchange of information. In planning the *Handbook of Birds of the World*, which will provide a vast amount of information about all living species of birds to ornithologists, professional and amateur alike, and will run to a number of large volumes, the importance of maximizing the efficiency of communication was a major consideration. Success of this undertaking depends not only on the correctness of the included information, but equally on the organization with which this information is presented. Correctness of the information is the responsibility of the authors of individual family and species accounts, but the responsibility for the organization belongs to the editors. The editors had to balance the kind and amount of information presented for each family and species of bird against the number and size of the volumes, and hence the ultimate cost of the entire *Handbook*.

At the onset of planning, the decision was taken to include information on all living species of birds with a summary of the biology of the family-level taxa. Herein, the first major decision was to cover all living species rather than all recent species included in J. L. Peters' *Check-list of Birds of the World*. Extinct birds are excluded, although mentioned in the family texts, partly because one of the goals of this project was to interact with BirdLife International (International Council for Bird Preservation) in raising the awareness of problems in the conservation of extant avian species. The next decision to be made was regarding the sequence in which the families and species were to be presented, as well as the internal classification of each family, including the species recognized. Readers of this *Handbook* do not have to be told that it is impossible to reach agreement between two ornithologists on the limits of all avian species taxa and the classification in which they are arranged.

Regardless of the species definition accepted, recognition of species taxa depends on how allopatric representatives are treated. Haffer (1992) has shown that advocates of each major species concept range from extreme lumpers to extreme splitters. An intermediate course was chosen for purposes of this *Handbook*, but there will be numerous cases in which allopatric species have been recognized herein which other workers include in a broader polytypic species taxon, and vice versa. The editors have attempted to ensure that such cases are commented on. It should be mentioned that the scientific definition of the species concept and recognition of species taxa is totally independent of the legal meaning of species in treaties and laws on the conservation of living organisms.

The arrangement of avian species taxa into higher level taxonomic groups and the order in which the families and orders of birds are treated within the *Handbook* is a much more complicated problem. Over the past decades much research has been undertaken on the macrosystematics of birds and many differing classifications have been published. In 1990, C. G. Sibley and his associates published a classification for birds (Sibley & Ahlquist, 1990; Sibley & Monroe, 1990) which differed radically from the Wetmore-Peters system published in the late 1920's and broadly adopted by ornithologists for most of the twentieth century. In turn, the Wetmore-Peters system replaced the very different system used for birds which was established in the early part of the nineteenth century (1825-1840) and used by most ornithologists into the beginning of the present century. This earlier system was adopted in Sharpe's *Catalogue of the Birds in the British Museum*.

The more neutral term "system" was used above to avoid confusions between the several different concepts embraced within it, namely phylogeny, classification and sequence, as discussed by E. Mayr and W. J. Bock (1994). Birds can be arranged in a phylogeny, or in a classification, or in a sequence, all of which differ from one another and can convey quite different information. Evolutionary relationships (which can be considered roughly equivalent to history) within any group of organisms, including birds, can be expressed either as classifications or as phylogenies, which are distinct, non-redundant ordering systems. Each provides different information about the evolutionary history of these organisms (Bock, 1977, 1981, 1992; Mayr & Ashlock, 1991, chapter 6). Both ordering systems reflect our current and still tentative knowledge of evolutionary relationships, and have to be modified as our understanding improves.

Phylogenies group organisms according to their branching phylogenetic history in which each clade is holophyletic (containing all forms descending from a common ancestor), and they are often presented in a branching diagram. Cladistic classifications or Hennigian phylogenetic diagrams represent branching phylogenies only and are not general reference systems. Any group of organisms has had a single evolutionary history, and hence a single phylogeny exists for each group. Phylogenetic analyses attempt to discover this true phylogeny.

Classifications arrange organisms according to both the amount of phyletic evolutionary change (anagenesis) and the pattern of phylogenetic branching (cladogenesis), and are expressed as a series of monophyletic (having a common ancestor) taxa arranged in a Linnaean hierarchical system of inclusively nested groups. Classifications reflect the entire evolutionary history of organisms, not only the patterns of branching points. They serve as general reference systems and are heuristic (serving to aid learning, discovery, etc.) in nature. Classifications are used to summarize efficiently information about organisms, to formulate useful hypotheses for empirical testing, and as the foundation for all types of information storing systems. Generally more than one equally valid classification can correspond to the single phylogeny of the group. Classifications are usually presented in a linear form, but this is not essential. Because classifications are generally presented in a linear sequence, the concepts of classification and standard sequence are still confused by most systematists and are usually considered to be identical.

Important distinctions exist between provisional classifications and standard sequences which serve two exceedingly different purposes in biology. Standard sequences serve strictly for arranging taxa in a linear order in books and all other information retrieval systems for the convenience of the user, who will be able to find the desired information more quickly. They exist for the general worker, who must organize and exchange information about organisms in a taxonomic group, such as birds. Classi-

fications, on the other hand, are the result of taxonomic studies and serve as the basis of discussion among specialists in systematics. Unfortunately, most workers have confused classifications with standard sequences and have changed the sequences with every proposed modification in classification. The failure of biologists to make the proper distinction between them has caused enormous difficulties since the earliest days of biological taxonomy, and has greatly reduced the usefulness of standard sequences.

Standard sequences are strictly heuristic devices, made necessary because humans arrange knowledge in linear systems, such as books, libraries, information retrieval systems, and the like. These standard linear sequences are derived from classifications, and generally several equally valid standard sequences can be postulated from a single classification. Taxa in a standard sequence are listed in a linear order, following a few general rules, such as more primitive groups placed first, and closely related groups placed close to one another. Discontinuities in relationships will occur in the sequence between the end of one complex of related taxa and the beginning of the next. Most important is that when agreement has been reached on a standard sequence, it be maintained over a long period of time. Changes in a standard sequence should be made only when there has been wide acceptance of radical modifications in the underlying classification.

Hence in the early stages of planning the *Handbook*, the decision was made to follow the Wetmore-Peters' sequence, which has been the widely accepted standard version for ornithologists worldwide ever since its appearance in the late 1920's, as the foundation for the fourth edition of the AOU Check-list of North American Birds in 1931 (Wetmore, 1930, 1960). The sequence given in *The Reference List of Birds of the World* (Morony, Bock & Farrand, 1975) was followed rather than the Peters volumes, because it adopted many later revisions and included taxa described since the early volumes of Peters. Use of the Wetmore-Peters sequence will permit readers of the *Handbook* to compare most easily information given in these volumes with that in most other books on birds published since 1930. No claim is made on the correctness of the classification on which the Wetmore-Peters sequence is based relative to other published classifications. The principal object of this *Handbook* is the maximum exchange of information, rather than an attempt to promote the scientific merits of different avian classifications.

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References Cited

- Bock, W.J. (1977). Foundations and methods of evolutionary classification. Pp. 851-895 in: Hecht, M. *et al.*, eds. *Major patterns in vertebrate evolution*. NATO Advanced Study Institute, Ser. A 14. Plenum, New York.
- Bock, W.J. (1981). Functional-adaptive analysis in evolutionary classification. *Amer. Zool.* 21: 5-20.
- Bock, W.J. (1992). Methodology in avian macrosystematics. *Bull. Brit. Orn. Club* 112A(Centenary Suppl.): 53-72.
- Haffer, J. (1992). History of avian species concepts and species limits in ornithology. *Bull. Brit. Orn. Club* 112A(Centenary Suppl.): 107-158.
- Mayr, E. & Ashlock, P. (1991). *Principles of Systematic Zoology*. Revised Edition. McGraw-Hill, New York.
- Mayr, E. & Bock, W.J. (1994). Provisional classifications versus standard avian sequences: heuristics and communication in ornithology. *Ibis* 136: 12-18.
- Morony, J.J., Bock, W.J. & Farrand, J. (1975). *Reference List of the Birds of the World*. American Museum of Natural History, New York.
- Sibley, C.G. & Ahlquist, J.E. (1990). *Phylogeny and Classification of Birds: A Study in Molecular Evolution*. Yale University Press, New Haven, Connecticut.
- Sibley, C.G. & Monroe, B.L. (1990). *Distribution and Taxonomy of Birds of the World*. Yale University Press, New Haven and London.
- Wetmore, A. (1930). A systematic classification for the birds of the world. *Proc. US Nat. Museum* 76(24): 1-8.
- Wetmore, A. (1960). A classification for the birds of world. *Smithsonian Misc. Coll.* 139(11): 1-37.

Introduction to Volume 2

As this volume forms part of a series, the *Handbook of the Birds of the World* (HBW), readers are referred to the detailed general introduction to the whole work, on pages 15-33 of Volume 1, where they will find an explanation of the aims of the project, the structure of the whole work, and the objectives and contents of each of the various sections, all of which is, of course, applicable to the present volume. It has been considered unnecessary to repeat all of these details in this and forthcoming volumes, as they will remain essentially the same throughout the series.

One significant change to the original planning is the result of a comprehensive revision of the whole project, taking into account the experience gained in the first volume. This has led to the number of volumes in the series being extended from ten to twelve, a number which can now be considered practically definitive.

A few innovations have occurred with this second volume, the most significant of which involves the extensive internationalization of the team of authors. As the authors are experts in their own particular fields, overall editorial policy has been to respect the diversity of styles as far as possible, while at the same time aiming to maintain a suitable degree of consistency throughout the entire work. It is now up to the individual reader to judge whether or not an appropriate level of consistency has been achieved.

As in Volume 1, each family text and its respective species accounts have normally been prepared by a single author, or sometimes by two working together. However, there was one particularly awkward case in this volume, that of the two large families of diurnal raptors, Accipitridae and Falconidae, which in total amount to some 300 species. Given the size of the task involved, it was decided that the species accounts of the two families might to advantage be divided up amongst a team of regional authors. With so many species involved, each author was likely to have more extensive experience with those of a particular region, and so would be better prepared to cover them. This system has had the obvious benefit of reducing individual workloads, and has undoubtedly enabled each author to give fuller attention to the particular set of species allotted to him. On the other hand, the system has also presented several drawbacks, perhaps most significantly in the different styles and criteria inevitably employed by the eight different individual authors. During the subediting process, a degree of uniformity has necessarily been imposed on the accounts, but this has been balanced with a strong tendency to respect each author's contribution as far as has been possible.

Classification

Another important innovation with Volume 2 is the participation of Walter Bock, in the capacity of Consultant for Systematics and Nomenclature. Professor Bock is Secretary of the International Ornithological Congress (1986-1998) and Chairman of the Standing Committee on Ornithological Nomenclature.

From the first, taxonomy has been considered one of the major concerns in the whole project, and we firmly believe that HBW will prove to be a useful tool for all ornithologists, in this field in particular, as it attempts to cover all the major

taxonomic alternatives, from the level of order right down to subspecies, for all the world's birds, complementing these details with the individual illustrations and map for each species.

It should be stressed that Professor Bock is not to be held responsible for all of the details of the sequence followed, nor for the species, far less the subspecies, accepted. As consultant, he is working in close conjunction with the editors, monitoring particular problem cases and ensuring that taxonomic treatment remains consistent and appropriate throughout the entire work, especially at the level of macrosystematics. We are delighted to be able to count on his participation in HBW, and that the project will gain from his wealth of experience.

In the normal procedure of HBW, while the higher taxonomic levels are decided centrally, the internal classification of each family is a matter for open consultation with the individual authors. In the entire process of preparing Volume 2, there has been a great deal of lively and positive discussion of taxonomic issues with the various authors. This was most notable in the case of the largest family, Accipitridae, in which the family author proposed the original version, and the species account authors made a number of useful proposals, several of which led to slight amendments and an overall improvement in the list. The HBW sequence has benefited greatly from the considerable experience of expert authors, and, as a result of the minor amendments made to several families, some of the taxonomic arrangements presented herein are to a certain extent new.

Nevertheless, as explained in Volume 1, for its basic overriding principle, HBW follows the currently accepted standard sequence of the Class Aves (see Mayr & Bock, 1994, *Ibis* **136**: 12-18.), with a limited amount of modification permitted, where recent work shows it to be appropriate. For instance, there is no apparent advantage in maintaining species status (with a corresponding species account) for taxa that have in the past been considered full species, but are now known to be subspecies, or simply morphs or hybrids, or even, in some cases, juveniles or females of other species. Similarly, newly discovered species must be accommodated, which necessarily requires a few small adjustments. The acceptance of subspecies is not considered to be a matter affected by the concept of "standard sequence", so authors are relatively free to accept the versions that they find most satisfactory on the strength of present evidence; nonetheless, the preference in this respect in HBW is still to limit the incorporation of recent innovations to those that appear to be suitably justified.

Where the standard sequence is of major significance is at the macrosystematic level. For this reason, despite the fact that the New World vultures (Cathartidae) are now generally reckoned to belong alongside the storks (Ciconiidae), they have been treated in their traditional position within Falconiformes, although the issue is given full treatment in the family text. On the other hand, while awarding a full family to the New World quails is an idea that has only fairly recently come into vogue, based largely on the work of C. G. Sibley and J. E. Ahlquist, there appear to be good grounds to support this change, and it has been considered more consistent with the recognition of a narrow concept of Phasianidae with respect to the turkeys, grouse and guineafowl, a subdivision that is steadily gaining support; again, such issues are extensively covered in the relevant family texts. The Hoatzin (*Opisthocomus hoazin*), in its monotypic family, Opisthocomidae, presented a difficult case, as this species has often been placed in the Galliformes, although there has been a strong movement in recent years to transfer it to Cuculiformes, a proposal, which, in turn, has received forceful criticism. The answer seems to be that nobody really knows where this species belongs, so for the time being it has been deemed most suitable to award the Hoatzin an order of its own, Opisthocomiformes, alongside the Galliformes, as it does not appear to be closely related to any other living species. This treatment was already proposed by E. Stresemann in 1934, and was recently revived by H. Sick, in the major reference work covering this species' range.

Of interest is the inclusion in HBW of a newly described perdicine, *Xenoperdix udzungwensis*, a species so distinctive that it has been awarded a genus of its own. The acceptance of newly described species can obviously present a certain degree of risk, as subsequent study has in the past frequently invalidated new "species". However, this particular species is very distinctive, and its inclusion is important both as an additional illustration of the diversity within the family and for a series of possible biogeographical implications. Nonetheless, in a number of other more doubtful cases, in which certain forms have at times been claimed to constitute new species, the tendency in HBW is to avoid the acceptance of such "species" until such time as their validity be proved, or at any rate widely accepted; such was the case, for instance, of the form "*Crax estudilloi*". Again all such cases are discussed in the family texts.

There are other contentious issues. For instance, it was decided, based largely on the arguments of R. L. Potapov, to take two of the three species traditionally placed in *Dendragapus* and remove them to the reinstated genus *Falcipectens*. This proposal has received widespread approval, and, although it is not actually followed by the *Birds of North America*, the most important and most recent regional handbook to deal with either of the species in question, the text therein does comment that this is probably a more accurate version.

Another controversial case has been that regarding the generic name of the Crested Caracara (*Polyborus plancus*). There has been a recent move to annul the name *Polyborus* and replace it with *Caracara*, on the grounds that the former is unidentifiable. However, the almost universal usage of *Polyborus* over the last 150 years or so, together with the fact that it is the basis for the subfamily name Polyborinae, a family-group name, argues strongly in favour of the retention of *Polyborus*.

With respect to the accepted German and Spanish names for the species in this volume, the sources are as credited in Volume 1 (page 26); publication of the list of Spanish names is now under way, the first batch recently appearing in *Ardeola* 41(1): 79-89 (1994). An important advance was the publication in 1993 of a new, comprehensive list of French names carefully selected by an international committee, with the aim of providing a more or less definitive list, which diverges as little as possible from those names already selected by P. Devillers:

– Devillers, P., Ouellet, H., Benito-Espinal, É., Beudels, R., Cruon, R., David, N., Énard, C., Gosselin, M. & Seutin, G. (1993). *Noms Français des Oiseaux du Monde*. Éditions MultiMondes, Sainte-Foy, Quebec, Canada & Éditions Chabaud, Bayonne, France.

Conservation

As readers of Volume 1 will already know, the theme of conservation has a high profile throughout HBW. In the families Megapodiidae, Odontophoridae, Phasianidae and Numididae, each species account carries, in addition to the IUCN threat category, a new Mace-Lande category; at present, these new categories are not available for the other families, although preparation of those for raptors has recently commenced. As the Mace-Lande status provides a more accurate reflection of the information available, it is worth explaining briefly.

It has long been felt that the system for deciding IUCN categories is too subjective. Now, following considerable efforts, a new system is emerging, that of the Mace-Lande criteria, so-named after its originators, G. M. Mace and R. Lande. A certain amount of fine tuning has been necessary, but this new system has now been applied experimentally to certain bird groups.

The new system bases its conclusions, and the ensuing application of categories, on population data, but as this requires the sort of information that is simply not available for most species, the criteria are concerned with the probability of extinction of a given species within various periods of time. Thus, if the species is believed to have a 50% probability of extinction within two generations (of the species), it is considered Critical; a 20% probability of extinction within 20 years qualifies as Endangered; and a 10% probability within 100 years is sufficient for it to be classed as Vulnerable. Criteria based on characteristics such as the sizes of populations, their degree of fragmentation and observed decreases in numbers can be used where the data exist, but, for the time being, in most cases classification has to be based on factors such as the rates of habitat loss or of direct exploitation by humans. For instance, habitat loss may be reckoned to occur on such a scale that, if it continues at the same pace, the species faces the aforementioned probabilities of extinction in the suggested time frames. Even so, assessments are not easy, and in many cases species can only be narrowed down to a range of two categories, such as Vulnerable/Endangered.

Another major step forward with the Mace-Lande system is that it is being applied to all of the species, and to several of the more distinctive subspecies, in a given group or family. Assuming the Mace-Lande experiment prospers, it is hoped that it will eventually be applied to all of the world's birds, and will ultimately replace the traditional IUCN categories. However, for the time being the new system has yet to be perfected, and, as its application requires a great deal of research effort, the IUCN categories are likely to remain the standard for some time to come. Therefore, HBW will continue to stick to the IUCN categories, until such time as they can be replaced for the entire bird world by a new, improved system. For this

reason, in order to enable the different families in the present volume to be compared on an equal basis, the figure referring to the number of threatened species in the summary-box of each family invariably refers only to the IUCN listing, even though within the body of the text, the author may well prefer to follow the Mace-Lande criteria, as is the case in the Status and Conservation section of the family Phasianidae. In the species accounts of the four families affected, both categories have been given: first the IUCN category, in its normal form; and then the Mace-Lande category, appropriately indicated. Note that in several cases individual subspecies or subspecies clusters are awarded independent categories, in which case the category appears written entirely in small case, as opposed to the use of a capital initial letter with the Mace-Lande category of a full species (in the species account); when subspecies are clustered, and thus treated as a single entity, each subspecies is separated from the next by a slash. IUCN categories are taken from the 1994 IUCN Red List of Threatened Animals.

As in Volume 1, all species protected under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) are thus indicated in the Status and Conservation sections of their respective species accounts. This includes mention of the Appendix (I, II or III) in which the species in question is listed. Briefly, for most purposes, Appendices I and II both indicate strict protection, although the former, used mainly for seriously threatened species, is rather stricter, precluding the possibility of trade permits being granted in virtually all cases. Appendix III indicates a similar level of protection to that implied by Appendix II, but only in the country or countries listed.

Illustrations

Another important innovation with the present volume lies in the fact that several prestigious British artists have joined the already successful HBW team from Volume 1. The workload involved in Volume 2 and foreseen for future volumes has meant that a larger team of artists was required in order to ensure that all the deadlines could safely be met, and that artists were not forced to rush their work. In the interests of consistency and ease of comparison, attempts have been made to have all the members of well defined groups painted by the same artist, but for practical reasons (including the schedule for Volume 2) this has not always been possible. The most extreme case is that of *Accipiter*, which has been painted by four different artists. As a result, some of the differences between species may be less apparent due to the distinctive styles of individual artists; on the bright side, however, it does at least offer a good comparison of the different styles used by these four different artists! Similar efforts have been made to avoid individual genera, or associated species, being split between plates. In general, solutions have been found for most cases, but there are a few exceptions resulting from restrictions imposed by the lay-out, notably in the cases of *Crax*, *Aquila* and *Buteo*.

One of the few points that may be worth repeating from Volume 1 is that HBW does not aim to serve as a field guide, even for those who may be capable of going out into the field carrying twelve large volumes. Nevertheless, in this and subsequent volumes, in the cases of some of the more poorly known species, especially those that are not particularly well served by field guides, a slightly more detailed description may be permitted on occasion, for instance for the *Odontophorus* wood-quails, as it is believed that such information is not otherwise readily available.

The business of selecting the photographs to be published has seen a considerable increase in the amount of time and effort dedicated to research, and, as a result, during the selection process many more photos have been examined from a larger number of photographic agencies, and also from a great many individual photographers who have offered their work for consideration. Inevitably, for some of the galliform families only a rather limited number of photographs of wild birds were available, which has led, in two families, to the inclusion of a number of shots of captive birds, in order to illustrate the diversity of the family adequately. Nevertheless, even in the worst case, the number of photos of wild birds remains high. One slight change with respect to the first volume is in the increase in the number of montages employed. It is hoped that it will be possible to include these useful and highly illustrative series in future volumes, although, of course, this necessarily depends on availability.

As in volume 1, the maps do not normally include a species' introduced range, but in a very few clear-cut cases, such as that of the Canada Goose (*Branta canadensis*) in Volume 1, it has been deemed worthwhile to do so. The one and significant case in Volume 2 is that of the Ring-necked Pheasant (*Phasianus colchicus*), which

is so well established in many parts of Europe and North America. Nonetheless, the introduced range of this species has not been included in the family map, as to do so would give a highly erroneous view of the family's natural distribution, with significant biogeographical implications for the whole of the order Galliformes. A second kind of exception has been permitted, again in an extremely limited number of cases. This has involved the maps of both the Mountain Quail (*Oreortyx pictus*) and the California Quail (*Callipepla californica*) including populations that are very probably, but not certainly, introduced; these populations are included partly because of the doubt as to whether or not they really are introduced, partly because the distributions of the natural populations are contiguous and continuous with those of populations that are probably introduced, and partly because, for practical reasons, it would be difficult to draw the line between natural and probably introduced populations.

Bibliography

Although already explained in the introduction to Volume 1, it must again be stressed that the bibliography listed does not mean that which has been used in composing the text, but rather "recommended further reading", although there is obviously extensive overlap between the two. The bibliography recommended for any one species consists of that listed at the end of the relevant species account, in addition to that listed under the General Bibliography of the family. The latter often includes monographs that deal individually with each and every one of the species in the family, and in some cases may contain more material about a particular species than any of the references listed under that particular species. This might appear illogical, but it was decided that there is little to be gained in repeating the same reference for every single species in a family, particularly when economy of space and concentration of information are two of the dictating factors in the whole project. At the same time, many of the general works that do not actually go through all the species in a family one by one nonetheless present a great deal of important information on particular species, while in any case general considerations on the family as a whole are invariably relevant to the constituent species too. The bibliography of this volume thus follows the same norms as those already employed in the first volume.

A couple of small points may be worth mentioning. First, at variance with usage in Volume 1, it was decided, on the recommendation of K. C. Parkes (*per* J. P. Carroll), to adopt the version "Meyer de Schauensee, R.", as opposed to "de Schauensee, R.M." Second, the Scandinavian forms *å* and *ø* are alphabetized as *a* and *o* respectively; this procedure was already adopted in Volume 1, but an explanation was inadvertently omitted from the introduction. Although this is not the normal order in the relevant languages, it has been considered that it would be most confusing for the vast majority of readers to have them listed otherwise.

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Museums have again played a most important part in many aspects of the project. We would particularly like to thank the British Museum of Natural History at Tring (Robert Prys-Jones, Peter Colston, Michael Walters, Mark Adams). We are also very grateful for the help received from the American Museum of Natural History in New York (Mary LeCroy, Paul Sweet), the Smithsonian Institution in Washington (Gary R. Graves, Richard L. Zusi, J. Phillip Angle, Carla Dove), and the Academy of Natural Sciences of Philadelphia (Mark Robbins). Generous assistance has also been received from the National Museums of Scotland in Edinburgh (Bob McGowan), the California University of Pennsylvania, the CSIRO Australian National Wildlife Collection in Canberra, the Carnegie Museum of Natural History, the National Museums of Kenya in Nairobi, and Liverpool Museum (Tony Parker).

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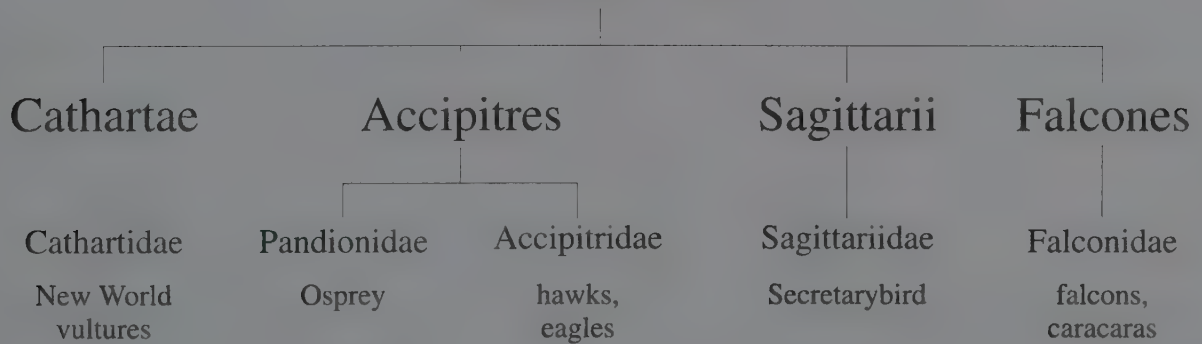
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Order FALCONIFORMES

Falconiformes



Class AVES

Order FALCONIFORMES

Suborder CATHARTAE

Family CATHARTIDAE (NEW WORLD VULTURES)



- Medium-sized to very large diurnal birds of prey, with bare head, powerful hooked bill and large wing area for efficient soaring flight; feed mostly on carrion.
- 56-134 cm.



- North, Central and South America
- Wide variety of habitats, from highest mountains to low-land forests and deserts.
- 5 genera, 7 species, 13 taxa.
- 1 species threatened; none extinct since 1600.

Systematics

The seven species of New World vultures are extremely similar in superficial appearance to the fifteen species of Old World vultures found in Africa, Asia and Europe. If seen in a mixed species group in a zoo aviary it is difficult to find clear features to tell them apart.

The most obvious differences are that the New World vultures do not have a functional hind toe, and also have no internal separation of the nostrils, so that when the head is viewed from the side it is possible to see right through the head and out the other nostril. Otherwise the two vulture groups are remarkably alike in general appearance. Both have powerfully hooked bills, bare heads and necks, and massive wings to enable them to ride rising air currents. It is a feature of all vultures that they fly almost entirely by soaring flight and rarely flap their wings. Indeed the larger vultures are incapable of using powered flight for any length of time, and may be completely grounded if they can not find suitable upcurrents of air. This dependence on soaring flight allows them to travel great distances with little energy expenditure. Both groups feed almost entirely by scavenging meat from carcasses, and rarely or never kill prey themselves. Both vulture groups also show little sexual dimorphism, which is unusual among birds of prey. In most species, therefore, the male and female can not be told apart from size or plumage differences.

These similarities between the Old World and the New World vultures are, however, now known to have been derived independently because the two groups are actually descended from totally different ancestry. They are a text-book example of convergent evolution. New World and Old World vultures look alike not because they are closely related, but because they have developed the same adaptations for a similar way of life.

It is perhaps worth emphasizing the remarkable convergence shown by these two lines of vultures. In both Eastern and Western Hemispheres it is usual for several species of vulture to co-exist in the same areas, forming a guild of scavenging birds. The same forms of feeding specialization have evolved independently in the two groups.

Thus, in both the New and the Old World, there have evolved very large species, the condors (*Vultur*, *Gymnogyps*) and the griffon vultures (*Gyps*), which share many features. They are among the largest of all flying birds, have compara-

tively drab, dark plumage with a white neck ruff, travel great distances when foraging, congregate in large numbers at carcasses, and use their long necks to reach the muscle and viscera.

Both vulture groups also evolved medium-sized to large species, such as the King Vulture (*Sarcorampus papa*) of the New World and the White-headed Vulture (*Trigonoceps occipitalis*) and the Lappet-faced Vulture (*Torgos tracheliotus*) in the Old World. These species all tend to be more brightly coloured; may have more restricted foraging ranges; do not usually collect in large numbers at carcasses; have comparatively short necks; and specialize at carcasses in taking the skin and tough tissues, such as tendons and sinews.

Finally, in both the New World and Old World vultures, there have evolved smaller species, such as the American Black Vulture (*Coragyps atratus*) and the Turkey Vulture (*Cathartes aura*) of the New World and the Hooded Vulture (*Necrosyrtes monachus*) and the Egyptian Vulture (*Neophron percnopterus*) in the Old World. These travel considerable distances while foraging, and are very catholic in their diet, catching many prey items for themselves; they are not as dependent on large mammal carcasses as the bigger vulture species. When they do attend large carcasses they tend to feed on food dropped by the other species, and clean scraps of meat from the bones of the carcass after the larger species have left.

Despite these close similarities in appearance and feeding ecology of the two vulture groups, there are many aspects of their detailed anatomy and behaviour which indicate that they are not at all closely related. Huxley, as far back as 1876, recognized that the cathartid vultures were distinct from all other birds of prey, and for over a hundred years it has been known that many of their features are closer to those of the storks than to those of eagles and hawks.

Most of the evidence for this linkage is very technical, and A. Rea and J. D. Ligon have provided good reviews of the anatomical evidence. Storks and cathartid vultures share numerous characteristics of skeletal bone structure and skull formation, together with the arrangement of some of their musculature. There are also behavioural links with the storks: for example, both groups of birds keep cool by squirting their legs with urine, which then evaporates off to leave the legs sometimes looking as if they have been whitewashed. Additional evidence has recently been provided from DNA hybridization studies by C. G. Sibley and J. E. Ahlquist. This technique, which indicates the similarities in the DNA of various animal

Although it is now known that the New World and the Old World vultures evolved independently, there are marked similarities between the two groups. The strongly hooked bill and the bare skin on the head and neck are parallel adaptations to their similar feeding habits. However, this photo highlights one of the most obvious morphological differences, namely the lack of any internal separation of the nostrils in the New World vultures, with the result that it is possible to see clean through, from one side to the other. The other obvious difference in morphology is the lack of a functional hind toe in cathartids.

[*Cathartes aura septentrionalis*.
Photo: Jeff Foott/
Survival Anglia]



species, also suggests that New World vultures are more closely related to the storks than to the other birds of prey. In light of all this evidence it is rather surprising how reluctant ornithologists have been to recognize that the taxonomic position of the American vultures ought to be moved away from those of the other birds of prey.

Cathartid vultures have traditionally been placed in the order Falconiformes alongside the eagles and hawks, the falcons, the Osprey and the Secretarybird. L. H. Brown and D. Amadon, in a major text on birds of prey in 1968, recognized that these four groups of birds may not be related, and that the American vultures in particular were distinct in a number of ways. The traditional grouping of the Falconiformes has, however, largely been kept together as a matter of convenience, and because few could agree on what a more taxonomically correct relationship should be. There is some sense in this, because ecologically the cathartid vultures are so similar to the Old World vultures. But this does not reflect their real position, which may be in Ciconiiformes, or in a separate order, Cathartiformes. We should regard the cathartid vultures as sharing a common ancestor with the storks. Some modern stork species, especially the Marabou (*Leptoptilos crumeniferus*), obtain much of their food by scavenging, not only taking dead fish, but also feeding alongside vultures at carcasses. It is not too difficult to imagine a branch of these waterbirds becoming increasingly specialized for scavenging, and slowly evolving the same range of adaptations for this lifestyle as the Old World vultures.

We know very little about the relationships of the species to each other, although current studies on DNA sequence may provide information on this soon. It may prove that some of the genera are not at all closely related. We do know that the cathartid vultures have a very long evolutionary history, much longer than that of many other bird groups, with two fossil species *Palaegyps* and *Phasmagyps* coming from the early Oligocene about 35 million years ago. Modern genera may therefore have diverged long ago. Pliocene deposits, dating back about 5 million years, contain ancestors of the modern Andean Condor (*Vultur gryphus*) and King Vulture. During the Pleistocene in North America, around 2 million years ago, there was a great radiation of all vulture species, and at this time the modern California Condor (*Gymnogyps californianus*), Ameri-

can Black Vulture and Turkey Vulture were already found, together with many other species that have since become extinct.

The two large condor species, the Andean Condor and the California Condor are both massive in size and live in mountainous regions. These species can weigh well over 10 kg, and such huge birds clearly need strong upcurrents of air to sustain their soaring flight, which probably limits their distribution to mountain regions or lowland areas where strong thermal upcurrents are produced. Their huge size gives them superficial similarities, but there is no reason to believe that the two condor species are closely related, and they probably diverged long ago in evolutionary time. Two other distinct genera, which comprise single species showing no obvious similarities with any other vultures species, are those of the King Vulture and the American Black Vulture. The American Black Vulture, in particular, shows a quite different series of social behaviour patterns to all the other species.

The most closely related group of species are undoubtedly the members of the genus *Cathartes*, all of which have a highly developed sense of smell, unlike the four previously mentioned species, which have none. Three species are usually recognized, the Greater Yellow-headed Vulture (*Cathartes melambrotus*), the Lesser Yellow-headed Vulture (*Cathartes burrovianus*) and the Turkey Vulture. The first of these species was, however, only described as recently as 1964. The distinction between these three species is based on overall size and on the colour of the head, a feature which is rather variable between individuals, and, in the case of the yellow-headed species, not well known. There are, however, at least four distinct races of Turkey Vulture, which also differ in size and head colour. The taxonomic position of all these species and races is very uncertain. We know that there are clines, involving a progressive increase in size from the south to the north, in the two North American races of Turkey Vulture. Clear distinctions in size between races or species are often not very apparent. The other characteristic, the skin coloration of the head, is very variable and also fades completely after death, leaving museum skins all looking very similar. The study of these *Cathartes* vultures from museum skins is therefore very confusing. It would not be surprising if future taxonomic studies based on DNA se-

quencing showed that some of the races of the Turkey Vulture were as distinct as the two yellow-headed forms, and should be recognized as distinct species.

One of the more surprising aspects of the evolution of the two vulture groups in the New and the Old Worlds is that their present geographical isolation is a comparatively recent event. There are fossil Old World vultures found in the New World, and fossil New World vultures found in the Old World. The Old World vultures were present in the Americas until very recently; indeed, fossil species from the late Pleistocene deposits of the Le Brea tar pits in California show that they may have become extinct as recently as about 10,000 years ago. They seem to have died out along with the many large mammals and other scavenging birds which perished at the end of the Pleistocene. However, there is no fossil evidence of New World vultures in the Old World from any later than the early Miocene, about 20 million years ago.

Morphological Aspects

Cathartid vultures share the general bill shape of other meat-eating birds, with a hooked tip and cutting edges. The larger species can exert considerable force when feeding, usually holding the food down with one or both feet, and pulling strongly upwards, using their leg and shoulder muscles to help them tear through tough tendons and sinews. The bill can also be used in a surprisingly delicate way, with a gentle nibbling action, being particularly effective at removing small items of meat from complicated bones and hidden crevices in a carcass. When vultures have finished feeding on a carcass the bones are picked clean of virtually all tissues, and this requires them to show great dexterity and delicate bill movements as well as brute strength.

All species have bare skin on the head and neck, which is an obvious adaptation to prevent the birds getting their feathers soiled with gore, when they poke their heads into carcasses. However, only the condors and the American Black Vulture regularly push their heads far inside the skin of animals, and even the other species which would not seem to need to keep their necks bare are still found to show large areas of bare skin.

It is likely that an equally important function of these bare skin areas is to assist with temperature regulation. There is a rich supply of blood vessels to these areas of bare skin, and birds use them to radiate excess heat away from the body. Some species, especially the King Vulture and the Andean Condor, have elaborate skin folds or crests to increase the surface area of bare skin and presumably make heat loss through this route more effective. Vultures may face more problems with head stress than most other tropical birds. This is because they routinely fly at very high altitudes, where the air temperatures can be below freezing and the speed of flight results in a considerable chill factor. They need a thick and effective feather insulation around the body to retain heat in these conditions. When these same birds land on the ground a few minutes later, they are then subjected to high temperatures and they may have problems getting rid of the excess heat through the thick plumage layer. In such circumstances, the bare skin patches may then be important as a route for heat loss to keep the birds from overheating.

These bare areas of skin are also important in some species for display. There can be few bird species which show quite such a spectacular and bizarre range of skin colours as those around the head and neck of the King Vulture, accentuated by skin folds and a pendulous wattle. Like all of the species which have brightly coloured skin around the head, these colours only develop in the adults. The immature birds always have dark grey or black skin. This makes it likely that the main functions of bright colours are individual recognition, threats or dominance interactions between adults. The intensity of these skin colours is, in some species, very variable in an individual, especially in the California Condor and the various species and races of *Cathartes*. There have been no detailed studies made of the function of these colour changes, but the two South American subspecies of Turkey Vulture, *C. a. jota*, which has a bright red head, and *C. a. ruficollis*, which has a duller red head but with a conspicuous whitish band at the back of the head, can both change the intensity of their red skin within a few seconds, presumably by constricting or dilating the blood capillaries in the skin. These colour changes seem to be important indicators of dominance, especially when birds are contesting feeding sites. Neither of the North American migrant



All vultures have huge wings that are well adapted for soaring flight, and these enable the birds to cover immense distances at a minimal cost in energy terms, when searching for carcasses on which to feed. Both condor species show very conspicuous white panels on the upperwing, which are thought to facilitate visual contact between individuals, as they are clearly visible from afar. The Andean Condor is the only member of the family that is sexually dimorphic; the large comb on this bird's forecrown indicates that it is a male.

[*Vultur gryphus*,
Santa Cruz, Argentina.
Photo: Günter Ziesler]

species, which have more purplish colours on the head, appear to show such marked colour changes.

Some cathartid vultures have air-sac systems, which can be inflated to increase the effectiveness of these bare skin areas for display, and maybe also to assist in sound production. These air-sacs in the neck are also found in the Marabou and other members of the stork family. They are particularly well developed in the California Condor, where they are important in the courtship display of both sexes, the skin blowing up like a balloon and emphasizing the brilliant colours of the neck. But they are also found to much less dramatic effect in Andean Condors, Turkey Vultures and American Black Vultures.

A conspicuous feature of the *Cathartes* species, the Turkey Vulture and the Greater and Lesser Yellow-headed Vultures, are the large nostrils on the side of the bill. The cathartid vultures, alongside the New Zealand kiwis (Apterygidae) and some petrels (Procellariiformes), are among the few birds in the world which have a highly developed sense of smell. K. Stager carried out some carefully designed experiments to demonstrate that Turkey Vultures could detect some of the chemicals given off by carcasses, and could use them to home in on food. B. Bang has made detailed studies of the brain and olfactory regions of the skulls of *Cathartes* vultures to demonstrate that these species have unusually well developed olfactory lobes to the brain and nasal regions. The sense of smell is extremely important to these birds, and they rely on it entirely to locate food in forests, and can find carcasses that are completely hidden from view as easily as those which are visible.

Historically, this has been rather a controversial subject. John James Audubon carried out some experiments, which were published in 1826 and which he claimed demonstrated that these birds could not smell. But for his feeding trials he chose rotting carcasses, giving off the most foul stench that he could find, and concluded that, because the birds did not come to the putrefying food, they were unable to smell it. In fact, vultures do not like meat which is starting to decompose, and will avoid eating it if they can. This is probably because it is likely to contain unpleasant or dangerous bacterial toxins. Audubon's experiments failed to demonstrate that vultures could smell, because the birds did not bother to investigate the food, knowing that it would be in too foul a condition to eat.

A particularly puzzling aspect of the smelling abilities of these vultures is that it is only the three members of the genus *Cathartes* that have this ability. The condors, the King Vulture and the American Black Vulture all seem to have no functional sense of smell at all. In forest habitats, the two latter species cannot find food themselves, and instead rely on the *Cathartes* vultures finding it first. They then follow close behind and steal the food. If we assume that, taxonomically, these other vulture species are comparatively close to the *Cathartes* vultures, it is curious that the ability to smell should have developed in only these few species. We might expect that all vultures would benefit from being able to smell carrion, and we may well ask why they never developed this ability. We can only guess at the answer, but developing an acute sense of smell and a correspondingly large region of the brain to process the information may be costly. The brain uses far more energy in proportion to its weight than any other organ system in the body, and maybe for these other species the benefits they would gain from being able to smell for themselves are outweighed by the high energetic cost of maintaining the olfactory sense.

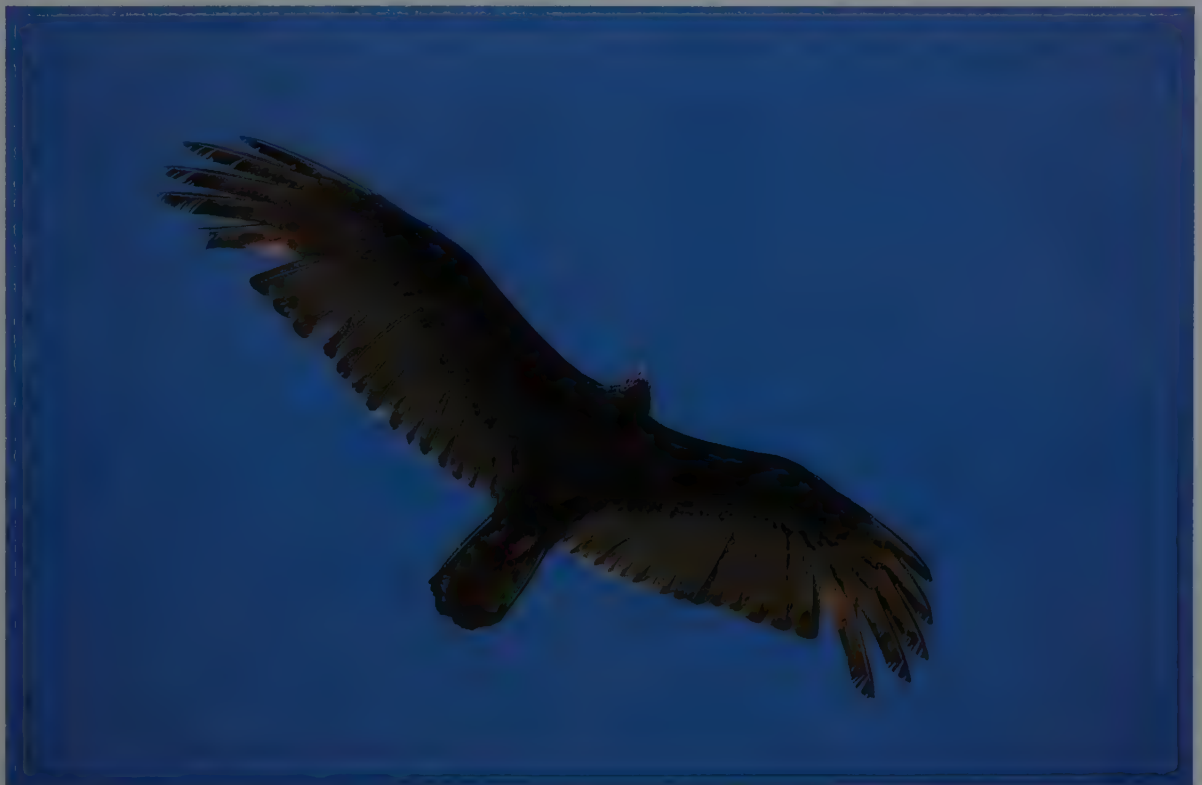
The general body plumage of most vulture species is rather dull in colour, usually being black, sometimes with some iridescence of the feathers. The immature plumages are always duller in coloration. However, some species show white patches on the wings when they are flying, these being particularly conspicuous in the Andean and California Condors and the King Vulture. These patches presumably make the birds conspicuous to other birds from a distance.

All vulture species are superbly adapted for soaring flight, and have large wing areas. They make use of rising air currents to gain altitude, rather than having to use flapping flight. The large condors are mostly found in mountainous areas, where they can rely on the wind rising up the windward side of cliffs and hills. In flat country they have to use thermal upcurrents, where the heat from the sun warms an area of bare ground, and causes the patch of air directly above to become hotter than the surrounding air mass, until eventually it breaks away and rises through the atmosphere, as a bubble of light, warm air. Many different soaring birds make use of these thermal upcurrents, and vultures depend on them for gaining altitude. Once they have climbed as high as they need, they then glide away, slowly

In order to take advantage of its acute sense of smell, the Turkey Vulture, like the other two members of the genus *Cathartes*, generally forages over long distances by flying relatively low above the ground. This bird is in active moult. Moult is extraordinarily slow in vultures, and the renewal of all of the flight-feathers takes several years. This strategy is necessary, for it means that the birds never have yawning great gaps in the wings caused by there being several contiguous feathers missing at the same time. The occurrence of such gaps impairs birds' flying proficiency considerably, particularly in terms of soaring and gliding, two abilities that are absolutely fundamental in the daily life of a vulture.

[*Cathartes aura*.

Photo: Mike Wilkes/Aquila]



losing altitude until they contact another source of rising air. This method of flying is extremely important, because it enables the birds to travel great distances while using very little energy.

Vultures have an unusual food supply, seeking carcasses that may be unpredictably located and spaced out very far apart. They can only exploit such an ephemeral, dispersed and sparse resource, if they have very low travel costs. They may need to travel enormous distances to find each carcass. If they had to use flapping flight, they would use more energy searching for food than they would ever gain by eating it.

Incidentally, this dependence on gliding flight has probably been the evolutionary force leading to the exclusive scavenging habits of all vultures. Both Old and New World vultures are descended from ancestors that were originally predatory. At some stage in their evolution, they have given up the ability to kill and become reliant on finding dead animals. This must have greatly restricted the potential sources of food available to the birds: if a vulture is hungry it can not go out and kill something; it just has to keep on searching and hope that it will eventually find a carcass. For any meat-eating bird there is always far more live, than dead, prey around. Vultures would seem to have lost a considerable advantage when they gave up the ability to kill for themselves. They would only have done so if there were some strong selective advantage which more than compensated for the loss of predatory abilities. The advantage they gained was that they were able to specialize on highly efficient gliding flight. To do this they developed massive wings and large body size. These changes prevented them from remaining as predatory birds, for they had to lose all the skills needed to be a predator, such as agility, accuracy of landing, ability to manoeuvre fast and take off rapidly if an attack has failed. But in return they have become perhaps the most perfectly adapted soaring land birds in the world, being able to fly for hours on end over hundreds of kilometres, without ever needing to flap their wings and while using minimal energy.

The various species differ considerably in their flying abilities. Some, such as the American Black Vulture, have comparatively low wing-loading (the ratio of body weight to wing area), which makes them rather inefficient gliding birds. They often flap their wings when they are flying, and in flat country can not start flying until several hours after dawn, when the heat of the sun is sufficient to generate powerful thermals. Other species, such as the two species of yellow-headed vultures, have larger wings and can keep flying even when they only have access to very weak areas of lift.

Vultures differ in their flying methods when searching for food. Some species, such as the King and Black Vultures, often fly at high altitudes, which enable them to gain excellent vision over large areas of the ground. But the *Cathartes* vultures fly much lower, close to the ground. In tropical forests, the Turkey Vulture and the Greater Yellow-headed Vulture fly just at the level of the tree canopy. They are able to do this by taking advantage of small patches of rising air on the windward sides of large trees which emerge above the rest of the forest. The Lesser Yellow-headed Vulture, which lives in flat grasslands, also flies only a few metres above the ground, possibly using small patches of rising air from bushes and small ridges on the ground.

Flight is so important to the lifestyle of vultures that they need to keep their flight-feathers in optimum condition. The feathers of all birds eventually become worn and need to be replaced. Most birds moult all of their flight-feathers every year. But moult in vultures is unusually slow. Even the small species take several years to complete the growth of a new set of feathers on the wing. It is very important that vultures do not develop holes in the wing, for this would impair their flying performance. Maybe if moult proceeded at a faster rate there would be a danger of gaps developing where several feathers were in growth at the same time. The sequence in which the feathers grow is also rather unusual. In most birds there is an orderly replacement of the primary, secondary and tail feathers, in which each quill is moulted and regrown in sequence. There

is such an order in the primary feathers in vultures, but secondary and tail moult is very much more irregular with no clearly discernible pattern to the sequence at which feathers are shed.

All vultures have large feet, which are often used in feeding, to help hold the food down while the bill tears off pieces of meat. The cathartid vultures have rather weak feet that are not as well adapted for grasping as are the feet of the Old World vultures. This may indicate their stork-like ancestry. Most species also have slight webbing between the toes, although this is probably not so much an indication of their descent from waterbirds as evidence of the way the feet are used as airbrakes to slow the flying speed of the birds as they come in to land. The larger species, in particular, have high flight speeds, and can have difficulty controlling their descent. They lower their feet to try and reach a safe landing speed, in just the same way as the Old World vultures, which, incidentally, also have slight webbing between the toes for the same reason.

Being a scavenger is rather a precarious way of life. Carcasses are difficult to find, but when one is found it is likely to contain plenty of food. One of the adaptations vultures have developed is the ability to eat large amounts of food. An Andean Condor is alleged to have eaten 8 kg of meat at one meal, which represents about two thirds of its body weight! This figure is not credible, but there is no doubt that some vulture species can really gorge themselves. The large condors can actually eat up to 2 kg, and may find it difficult to fly when they have eaten a large meal. They then wait a few hours, until they have been able to digest part of their food, before trying to take off, or if a predator approaches they may have to regurgitate part of their meal, until they are light enough to fly.

They are able to store these vast quantities of food because they have a capacious crop. This is a sac-like structure just before the stomach. It has very elastic walls, and as the bird fills it up with food the crop skin stretches and begins to bulge forward and become visible between the feathers on the chest. In many species the skin on the crop is brightly coloured, in Turkey Vultures a vivid red, in King Vultures bright pink, and in the Andean Condor a striking yellow or pink colour. These conspicuous crop patches are probably important signals about the feeding status of birds when gathered at a carcass. There can be few other birds which can beat the vultures for gluttonous appetites. When birds have the opportunity to gorge themselves in this way they then lay down large fat stores, to tide them over periods when food may be hard to find. We know that Turkey Vultures can go two weeks without food or water and appear to be quite unharmed. Charles Darwin reported that Andean Condors could last for five or six weeks without food.

Habitat

One of the remarkable aspects of the cathartid vultures is the extreme range of habitats that they occupy. In this respect they are more successful than the Old World vultures, which are not found in any kind of forest or closed woodland habitat.

The Andean Condor occurs amongst the highest peaks of the Andes, flying high over the snowfields seeking animals that have been killed by avalanches. In Argentina it also descends to low grasslands, and in coastal Peru it is found in total desert conditions, feeding on stranded animals along the sea coast. The California Condor has in recent years been confined to the Sierra Nevada range in California, although it formerly occurred over most of southern North America.

The Turkey Vulture is perhaps the most versatile of all the species, being found almost everywhere from extreme deserts to grasslands, temperate forests and even dense tropical rain forest. This species has been extending its range northwards in North America over the past few decades, and this has probably been encouraged by the abundance of food from animals killed by cars on the highways.

Another species that has probably extended its range and benefited from human activity is the American Black Vulture.

The Greater Yellow-headed Vulture is more closely tied to forest habitats than any other member of the family. Indeed, it appears to be almost entirely restricted to primary forest, and tends to shun even disturbed areas. Although both the King and Turkey Vultures also occur regularly in tropical forest, both can also be found in other kinds of wooded habitat, in more open areas, and even, in the case of the latter, in zones of desert.

[*Cathartes melambrotus*, Maraca Island Reserve, near Boa Vista, Brazil. Photo: David Houston]



This was, before the human population explosion, probably quite a rare vulture species, largely confined to the edges of rivers, swamps and wetlands. Today it is the ubiquitous town scavenger, present in thousands around fish markets and rubbish dumps, and walking the streets of most cities in Central and South America, feeding on garbage. It is the one vulture species which has clearly benefited from human activity.

The King Vulture is usually associated with undisturbed areas of tropical forest in Central and South America, but it can also be found in savanna and grassland areas, though usually only where forest pockets also remain.

It is often thought that vultures are tropical species, and do not penetrate into cold climates. But temperature is probably not as important to them as flying conditions: provided they can find the right conditions for soaring, and a suitable food supply, some species live in surprisingly cold conditions, such as the Turkey Vultures in the Falkland Islands or Tierra del Fuego.

General Habits

Every aspect of the ecology and behaviour of vultures is aimed at saving energy. This is the whole secret of their success. Finding cheap ways to travel, minimizing energy expenditure at all times, avoiding energy-wasting fights with colleagues at food sites, avoiding heat stress, digesting food as efficiently as possible, and storing away fat reserves whenever feeding times are good. These are all vital to their lifestyle. They have little control over their food supply, and so must be prepared occasionally to face periods when food is mighty hard to find. We know little about their general metabolism, but Turkey Vultures do seem to have metabolic rates that are considerably lower than we would expect for a bird of this size. It is likely that all of these birds have evolved mechanisms for reducing their energy requirements, especially when food supplies are low.

The American vultures are perhaps not as gregarious in their habits as the Old World vultures, some of which nest socially in huge colonies. Most cathartid vultures are relatively solitary when breeding, although some species, especially the American Black Vulture, will congregate together in large numbers when feeding, and roost in large communal roosts.

Some elegant studies on American Black Vultures by P. P. Rabenold have shown these roosts to be important social congregations. Birds use these communal roosts to learn about good feeding areas. A bird which has not been able to find much food one day can go back to the roost at night, and the next morning follow other individuals, as they leave to feed, so that it is likely to be led to a better food site. The members of the family group, the parents and their young, tend to remain together throughout the year. They preen each other, help feed each other, and defend themselves against attacks by other birds. Some family groups also tend to associate with certain other families, and family members probably assist each other when foraging, and co-operate in finding food. This species has, perhaps, the most complex social behaviour of all the New World vultures. It has a range of aggressive interactions that birds use in encounters with other American Black Vultures, which are more varied and unlike those known by any of the other vultures.

We do not know if other vulture species show similar social interactions. Turkey Vultures will often roost alongside American Black Vultures, and may benefit from learning about good places to feed in the same way. California Condors are known to have used communal roosts, and Koford, who was working in the 1940's, reports roosting groups of about twenty birds: presumably roosts were much larger earlier this century when the population was greater. Andean Condors also roost in groups. King Vultures seem to forage in family parties, and it is common for a pair of adults and their young to attend feeding sites together. Larger numbers will collect at the carcass of a big animal, but it is very uncommon to see more than two adults coming down to feed together. This species seems to have a more restricted foraging range than some other vulture species.

All of the vultures show well developed sunning behaviour. They stretch out their wings to their fullest extent, holding them either towards or away from the sun. They do this particularly in the early morning, but also regularly throughout the day. A whole roost of Turkey Vultures suddenly expanding their huge wings simultaneously to bask in the early morning sun is a most spectacular sight. The functions of sunning behaviour in birds are poorly understood, but the cathartid vultures perhaps use it more than most other groups of birds. It seems to serve two functions. Firstly, some species of cathartid vultures are



Sunning, with the back to the sun and the wings outspread is very typical amongst the New World vultures, in general, and the Turkey Vulture, in particular. Birds habitually sunbathe in the early morning, in sessions lasting half an hour or more. It is thought that the solar energy helps the birds to recover their normal daytime body temperature, which drops markedly at night, as the result of a thermoregulation mechanism that allows them to make considerable savings in energy expenditure. It has also been found that the sun's rays help to bring the plumage back into condition.

[*Cathartes aura*.
Photo: François Gohier/
Ardea]

known to allow their body temperature to fall several degrees at night. This is probably one of their many adaptations to save energy. In the morning, sunning is an effective way to raise the body temperature back to normal daytime levels. Secondly, the feathers of such large birds can become bent when they have spent long periods soaring, because the flight pressure tends to force the feather tips upwards. When the birds land, the feathers retain a rather bent shape, and will take many hours to recover. This may reduce the efficiency of the wing, and birds can speed up the recovery of the feather shape by sunning, as the sun's heat causes the keratin of the feather structure to relax back to the original shape. Most vultures will sun for a short period of time after landing, probably to maintain their flight-feathers in optimum condition.

Heat regulation is assisted by two rather unusual mechanisms. Mention has already been made of the bare areas of skin which are used to radiate excess heat away from the body. The birds also squirt urine onto their legs, and the evaporation of water helps to cool the skin. This strange behaviour is also shown by the storks, and sometimes leads to the legs becoming covered in white powder.

Feather maintenance is extremely important to all vultures, for their whole lives depend on the efficiency of their wings. If this efficiency is lost the birds will need to start flapping their wings more frequently, which uses too much energy. It is, therefore, not surprising that vultures may spend several hours each day at preening, carefully grooming each feather in turn, removing any dirt or food. In rainstorms they hold the wings out to wash the feathers, and then carefully preen them back into shape again.

One feature that all vultures must show is a remarkable ability to withstand bacterial toxins. We know that Turkey Vultures have a high resistance to botulism. Although birds will avoid eating meat that is in an advanced state of putrefaction, there is no doubt that they do regularly need to feed on meat that is far from fresh, and must have evolved mechanisms to detoxify most of the bacterial poisons that are present in decaying food. They have not, however, developed the ability to cope with the toxins with which man today pollutes the environment. Poisons such as strychnine and cyanide which are used in predator control programmes will all kill vultures, and

they seem also to be very susceptible to lead poisoning and other environmental contaminants.

Voice

A strange feature of the cathartid vultures is that they totally lack the syrinx and associated muscles, which form the main mechanism for sound production in other birds. As a result this whole group of birds are almost silent, and they completely lack the ability to produce any normal bird calls or song. They can produce a rather strange variety of hissing, rattling and sneezing noises, none of them very loud. These are probably made by passing air through the air sacs, but even these weird noises are not used extensively. They are at their most "vocal" when breeding, and anyone approaching a nest-site will often be greeted by a warning series of wheezes and snorts.

Food and Feeding

All species in this family are predominantly scavengers, in that they obtain food by finding dead animals, rather than killing prey for themselves. Some obtain virtually all their food this way, refusing to kill even animals that are obviously about to die. But the American Black Vulture does kill a surprisingly wide range of food items for itself, even if most of them are rather defenceless, such as hatching turtles, lizards or small nestling birds. They are also accused of attacking newborn lambs or calves, and undoubtedly wait around domestic stock to snatch the afterbirth. Turkey Vultures have also been reported killing prey, but usually only very sick or young animals. While it is likely that most species will occasionally kill, it is a general feature of the group that they can not, or will not, kill anything substantial, and the majority of their food is undoubtedly scavenged.

It is often assumed that all vultures feed at carcasses of large mammals. In fact the smaller species, such as the Turkey and American Black Vultures will take an extraordinary range of other food items, such as insects, dung, berries and fruits, small mammals, snakes and lizards. The keen sense of smell

of the *Cathartes* species probably enables them to find carcasses of very small animals, such as mice and small birds, as well as catching alive some less active prey, such as insects. Several studies on the food items taken by these species suggest that over much of their range these miscellaneous small prey items probably form a major part of their diet. However, all species will also congregate at the carcasses of large animals, and this is where differences in their feeding behaviour are most obvious.

The various species specialize by taking different types of food from a carcass, and also have a clear dominance hierarchy in the way that they feed. The large condors are the only species which are powerful enough to tear through the skin of large mammals, such as deer, and open up the carcass for the smaller species. In the forests of South America the King Vulture fulfils the same role, and, although it is a much smaller species, it can still open most carcasses, because the food supply in these areas consists of much smaller carcasses, such as monkeys and sloths. American Black Vultures are the main species to feed on the muscle and the viscera, and they have a very large gape for a bird of their size, allowing them to gulp down large amounts of food quickly. Turkey Vultures and both Greater and Lesser Yellow-headed Vultures feed more slowly, and it is these species which clean up any remaining scraps of meat on the bones, picking over the carcass until little remains.

With so many species, and individuals, competing for food around a carcass, it might be thought that there would be endless fighting. But for any bird with such delicate wings as those of a vulture, physical contact is dangerous and likely to lead to injury. Also, fights between vultures waste energy. So instead of having endless physical squabbles with other vultures, these birds have evolved ritualized displays which allow them to recognize more dominant individuals and resolve conflicts quickly. M. P. Wallace has shown that there is a clearly defined dominance hierarchy, in which the larger species dominate over the smaller ones. But most conflicts between species are resolved without physical violence. It is only the three *Cathartes* species which have the ability to smell, and so in woodland or

forest habitats it is almost always these species which find a carcass first. In more open habitats the other species may be first to spot a dead animal, but even here the *Cathartes* vultures are usually the first to arrive. These species feed with a rather quiet dignity, rarely engaging in aggressive encounters, and they will often allow other species to feed alongside them, provided they do not become too numerous. If they are challenged by another bird, they will usually quietly give way without a squabble. Frequently these birds find a source of food, only to have it stolen from them soon after they have arrived by other, more aggressive species. They then withdraw to wait on the sidelines, often coming back to the carcass again when the other species have left, and taking any scraps of remaining food. However, American Black Vultures are far less reticent and seem to enjoy a good scrap! They are generally far more aggressive in their behaviour. They have an elaborate series of threat displays which they use to interact with other conspecifics. One involves a curious form of arm wrestling, in which two birds stand side by side, with wings open, and push against each other until one falls over. Another involves birds leaping at each other and rising into the air, kicking at each other with their feet. American Black Vultures often congregate in large numbers at a source of food, and they can then make massed assaults and overwhelm the carcass, driving all other species away. Even King Vultures can be displaced by an unruly group of American Black Vultures.

The two condor species are today so reduced in numbers that it is difficult to visualize their original role as scavengers. There is remarkable archive film, taken in the 1930's, which shows several dozen California Condors feeding on a donkey carcass, in exactly the same manner as griffon vultures (*Gyps*) are seen today in Africa. Andean Condors were also, in the past, found in large groups at carcasses, although today it is usual to find only a few individuals together. These condors feed mainly on large carcasses. Along the Pacific coasts of North and South America the rich upwellings of the sea currents support a great concentration of marine life. This results in whales, seals and large seabirds being regularly washed up

Flocks of several dozen Andean Condors can form at carcasses, although throughout the species' vast range in the Andes and Patagonia, such congregations are nowadays found only in a few areas of Peru, Chile and Argentina, where the species still survives in good numbers. Juveniles of this species are easily identified by their dull brown plumage, which lacks the prominent white wing panels of the adults. Note also the adult females, which lack the conspicuous comb and neck wattles of the males.

[Vultur gryphus, Ayacucho, Peru.
Photo: Günter Ziesler]





Normally only a few King Vultures can be found feeding together, typically one or two adults and the odd juvenile, although larger numbers occasionally gather at sizeable carcasses. This suggests that the species may regularly feed in family groups, and perhaps also that such groups may maintain feeding territories. Although the King Vulture is dominant over the smaller vulture species, it usually tolerates their presence at carcasses, as in this case, where several American Black Vultures (*Coragyps atratus*) have joined in the feast. Note the all dark plumage of the immature King Vulture on the right.

[*Sarcophaga coragyps*, Hato Masaguaral, near Calabozo, Venezuela. Photo: David Houston]

along the beach. These must have been an important source of food for these birds in the past, and Andean Condors still forage along the seashore today. Inland, their prey was in the past mainly vicuña (*Vicugna vicugna*) and guanaco (*Lama guanicoe*) and any other large ungulates, but today domestic stock are also important sources of food.

It is not always realized that these scavenging birds play important roles in ecosystems. In Neotropical forests, for example, vultures are the major scavenging animals. The remarkable ability of the *Cathartes* species to smell out carcasses on the forest floor enables them to locate virtually all the animals that die. There is real competition for this food, from many scavenging mammals and insects which lay their eggs on carrion. But the superior searching efficiency of the vultures allows them to find almost all carcasses first. They are the major meat-consuming animals in the forests, probably taking more food than that taken by all of the predatory animals combined. They are also, in terms of their biomass, undoubtedly the most abundant "birds of prey" in this ecosystem. Indeed vultures are, in most habitats, so abundant that we tend to take them for granted. Their large numbers reflect how successful they are as scavenging animals, and how much better they are at finding dead animals than any other kind of scavenger.

Breeding

Surprisingly little is known about breeding in most of the cathartid vultures. For the Greater Yellow-headed Vulture no nest-site has ever been found, while only one is known of the Lesser Yellow-headed Vulture, and few of the King Vulture.

One of the curious features of the birds is that, although they share an ancestry with the storks, and might therefore be expected to build conventional tree nests like many stork species, none of the species is known to build any nest structure at all. All lay their eggs on the ground under dense bushes, in among boulder piles, at the back of caves, or in large holes in trees, tree stumps or fallen logs. Occasionally nests may be in tree cavities high above the ground, but this seems to be unusual.

The two large condor species usually select nests in remote sites that are difficult to reach. But the smaller species nest in

positions where they might be thought to be very vulnerable to ground predators. Birds do try to make their movements as inconspicuous as possible, when approaching the nest. In addition, the sites often become rather foul-smelling, which some people have suggested might be a deliberate strategy to prevent predators from taking the young birds, presumably by implying that they will not make a tasty meal. Also, the chicks of some species regularly wander away from the nest-site when they are old enough, and this may be another strategy to deter predators.

But predation of one kind or another does seem to be a major cause of breeding failure, and birds do not show strong nest defence. This even applies to a species as big as the California Condor, which might be thought well able to deal with most potential predators. But N. F. R. and H. A. Snyder showed that one of the main causes of breeding failure in this species was that their eggs were taken by ravens. It seems curious that such large birds are not better able to protect their nests. None of the species, as far as we know, are colonial in nesting. Some species will have a number of nest-sites close together, but there is no clearly developed sharing of defence of the nest-sites between pairs.

The large condors lay only a single egg, but the smaller American Black and Turkey Vultures usually lay two eggs. Eggs are usually an off-white colour, but Turkey Vulture eggs are spotted, maybe because they tend to lay in more open sites than the caves usually chosen by the condors or by American Black Vultures. N. Snyder actually saw a California Condor laying its egg, which was remarkable in that the female was standing upright at the time and the egg was expelled to the ground with some force. In those species which have been studied the eggs are incubated by both parents, and indeed most parental duties seem to be shared.

Incubation periods are rather variable, from about 40 days for the smaller species to about 55 for the larger condors. The chicks are initially covered in fine, fluffy down, which is white in colour in Turkey and King Vultures and the condors, but buff-brown in American Black Vultures. The young birds seem to be able to keep themselves warm from an early age, helped by the thick covering of down, and in Turkey Vultures parent birds only visit the nest-site to feed the chicks for a few minutes each day. Chicks are fed by the parents by regurgitation for the

An American Black Vulture about to feed on the corpse of an American alligator (Alligator mississippiensis). Of all the New World vultures, this is the species with the most varied diet. In addition to feeding on carcasses of almost any kind or size, it is the species that actually kills most prey, including newborn livestock, especially pigs, hatchling turtles, lizards, fish and nestling birds. It also takes the eggs of turtles, iguanas and birds, especially those of colonial nesters, and some vegetable matter, such as sweet potatoes and the pulp of opened coconuts.

[*Coragyps a. atratus*,
Florida Everglades, USA.
Photo: Brian Alker/
Planet Earth]



whole of their growth period. Vultures are unusual among birds of prey in that they do not carry food to the nest in the feet. They do, however, have such large crops that they can transport quite sufficient food in the gut. Very young birds, for the first few days, may be fed food which has been partially digested, but older chicks seem to receive undigested meals. At first the young take the food direct from the parent's bill, but later they may feed from regurgitated food placed on the ground.

From studies on captive birds, it seems likely that the larger condor species do not start breeding until about six years of age. The smaller species probably reach maturity after about three. The California Condor seems to form permanent breeding pairs, and, although we have little information from other species, the close family bonding shown by American Black Vultures suggests that these birds may form long lasting pairs also.

For the condors breeding is a protracted event. The eggs will take about 55 days to hatch, and the young bird will not start to fly until it is about six months old, after which it will remain dependent on the parents for many months. This means that a single breeding attempt in both the Andean and California Condors takes more than twelve months, and so a successful breeding attempt in one year usually results in no breeding attempt the following season.

Movements

The Turkey Vulture is the only species which is truly migratory, and this only applies to some of its races. Both of the North American subspecies travel south in winter, sometimes congregating in roosts of thousands of birds when they reach the winter areas. In Central America, birds moving north or south are funnelled through the narrow strip of land, contributing to one of the most spectacular raptor migrations in the world. They are dependent on following the land route because of their need to use soaring flight during migration, which prevents them crossing the Gulf of Mexico. Counts made in Panama indicate that in some years several hundreds of thousands of Turkey Vultures make this journey, sometimes rising to altitudes of 6000-7000 metres, and apparently without feeding to any substantial extent on the journey. The arrival of the huge numbers

of the North American migrant race into northern South America, where they then co-exist with the resident races of the same species, causes a great increase in the density of Turkey Vultures. There is clear competition between these races at this time, and D. Kirk showed in Venezuela that the migrant race is dominant at feeding sites and causes the resident birds to change their foraging areas and spend more time over the forests.

As far as we know, no other species makes substantial migrations, but many may make short distance movements that are not yet understood. It would be surprising if the arrival of the large numbers of migrant Turkey Vultures into South America did not cause some movement patterns in the resident small vulture species.

Relationship with Man

Vultures are large, spectacular birds, associated with death and cleaning of the body. It is perhaps inevitable that from early times human cultures have recognized vultures as important symbols of burial rituals and the release of the human spirit (see page 91).

Condors regularly appear in the pottery designs, textiles and carvings of the pre-Colombian cultures in the Andes. A condor forms part of the remarkable assemblage of huge designs drawn on the desert of the Nazca Plain in Peru by the Paracas/Nazca civilizations around 1000 to 2000 years ago. Condors were clearly important in mythology and figured in rituals of these early civilisations. Even today the Andean Condor appears on the coat of arms of Colombia, Bolivia, Ecuador and Chile, and so is obviously still a powerful symbol of national identity for the people of the Andes. The Order of the Condor is the highest order of merit in Bolivia. Condors feature in some modern festivals in the Andes, the most famous of which symbolizes the conflict between the Spanish Conquistadores and the native Indians. A condor is tied to the back of a bull, which is sent running through the streets of the town: if the condor survives, it is meant to symbolize the successful resistance of the Indians, and is released back to the wild the next day.



While the three *Cathartes* species all attend large carcasses, they tend to feed far more frequently on a wide variety of much smaller prey items, as in the case of these two Lesser Yellow-headed Vultures. This is undoubtedly connected with the excellent sense of smell possessed by the three species, which enables them to locate even very small carcasses, including those of small rodents and birds.

[*Cathartes burrovianus urubitinga*, Peru.
Photo: Günter Ziesler]

The form of worship of the Mayan culture is poorly known, but King Vultures sometimes appear as god-like figures and appears in manuscripts as the symbol of Cib, the thirteenth day of the month. Many prehistoric North American Indian cultures are known to have held the California Condor in particular respect, burying it with their dead, using its bones for whistles and its feathers for decorative bands, and representing its image on rock paintings.

There is no doubt that modern society views vultures in a very different way from early civilizations. They are now perhaps tolerated as useful, rather than being respected or admired. There is some direct persecution, often on the pretext of supposed damage to livestock, which has rarely been verified, or from thoughtless hunting. The most damaging relationship between vultures and men however comes from indirect persecution. As natural scavengers, vultures are at the end of the food chain. They are therefore likely to accumulate poisons, pesticides, heavy metals and other modern environmental contaminants. Their environment has suffered the addition of numerous modern hazards, such as power lines which provide new dangers to flying birds, as well as the danger of electrocution when birds perch on the pylons. Peril also lurks in the steep sided water troughs which are installed for cattle, and in which the birds can drown. We need to recognize the important role that vultures play in cleaning the environment and minimize the risks to their future survival.

Status and Conservation

Scavenging birds are particularly sensitive to human activity, but a curious aspect of this relationship is that, while some species have been brought to the brink of extinction, others have benefited to a spectacular extent. American Black Vultures and Turkey Vultures are today more abundant in agricultural and developed areas than in undisturbed habitats. These two species feed extensively on road kills, and squashed wildlife is, sadly, one food resource that increases every year. The steady move northwards of these two species in North America in recent years is probably associated with this increase in roadside snacks.

American Black Vultures have suffered persecution, because they are blamed for making attacks on newborn lambs and calves, and some thousands of birds have been trapped in

farming areas in the USA. This species is also blamed for spreading diseases of livestock. Their widespread habit of feeding on garbage dumps and then moving to food markets has also caused them to be suspected of spreading salmonella and other health hazards. This rarely leads to direct persecution, and the solution to this problem is to place better controls on waste disposal. Bigger threats to these two species are probably the chance of being killed by cars while feeding on the roads, and poisoning by eating some of the more bizarre items found on rubbish tips. These smaller vultures species, however, seem well able to withstand the current levels of persecution because of their potentially high reproductive rate.

Very little is known about the status of all the South American species. An indication of how little we know about these birds is the fact that the Greater Yellow-headed Vulture, although it is perhaps the most conspicuous and abundant of all large birds in the rain forest, was only scientifically described as recently as 1964. Direct habitat destruction by forest clearance is an obvious threat to all forest birds, and rightly arouses extreme conservation concern. Less widely appreciated is the extent of human exploitation of remaining forest areas. Any area of forest which has road or river access to human settlement is likely to be subjected to heavy hunting pressure. This rapidly removes the monkey species by shooting, and hunting dogs effectively remove most of the ground mammals. Within a few years primary forests can have much of their mammalian biomass removed by this relentless hunting pressure. This has an obvious impact on scavenging birds, by removing the source of their food supply. It is known that the density of *Cathartes* vultures is well correlated with the density of forest mammals. The King Vulture appears to be one species which rapidly finds it difficult to survive in areas of disturbed forest, presumably because the food supply is no longer able to sustain it. We know absolutely nothing about the population dynamics of this or the other forest species, and how vulnerable they may be to continued loss of mammalian biomass from forests.

But the species which are of most conservation concern are undoubtedly the two condors. The California Condor is one of the most endangered of all bird species. In 1987 the total world population had been reduced to 22 individuals. It is worth concentrating on the story of this species, for the research carried out on this bird gives us a clear picture of the potential threat facing all the other vulture species. Also the recovery programme for the California Condor is including conservation

The presence of two adults and a juvenile on this cliff ledge might suggest at first glance that this is a nest-site, but these Andean Condors are at a roosting site. In any case, both of the adults are males, and unlike many species of Old World vultures, no member of Cathartidae is a true colonial nester. On the other hand, these birds do roost in groups, and on such occasions several dozen condors and even several hundred of the smaller species may gather. It has been suggested that these communal roosts may act as information exchange centres, which, given that the birds depend on a dispersed and unpredictable food supply, would increase their foraging efficiency. Normally condors remain at their roosts for several hours after sunrise, and return to them several hours before sunset. It appears that the amount of time spent at the roost is closely related to the weather conditions, and in the case of the California Condor (*Gymnogyps californianus*) birds will not fly at all during days of thick mist or heavy rain.

[*Vultur gryphus*,
Santa Cruz, Argentina.
Photo: Günter Ziesler]



action for the Andean Condor, which may also be threatened now.

We should perhaps first ask why these two birds are now so threatened, or, in one case, critically endangered. Some people have regarded the California Condor as being a representative of a past Pleistocene fauna, originally dependent on the rich assemblage of mammal species which became extinct about 11,000 years ago. As such, it is a species which is doomed to extinction. There is no evidence to support this gloomy prospect. All the field evidence indicates that the range of the condor in North America contains abundant potential food and could support a large, viable condor population. The problem for the California Condor, as L. F. Kiff has pointed out, is that it failed to evolve a bullet-proof vest. The cause of the decline of the condor is a combination of direct, and indirect, human persecution. Once these factors are identified and removed there is no reason why condors should not thrive again in North America. In the meantime, conservationists have to fight to hold onto the species until the habitat can be cleaned up and made a fit place for condors to return to.

During the late Pleistocene California Condors occurred over much of North America. Fossils have been found from the west coast across to Florida and as far north as New York. But following the great Pleistocene extinctions, 11,000 years ago, the range of the bird became restricted to the mountains of the Pacific Coast. There the species fed on deer and sheep in the mountains, and on whales and seals washed up onto the beaches.

By early this century, the range had contracted to a small group of remote hills surrounding the San Joaquin Valley to the north of Los Angeles. Nobody knows the cause of this decline, but it was probably a combination of factors: egg-collecting was widespread, as was shooting, but probably far more important was poisoning. At that time, the normal method for farmers to kill wolves, coyotes and other potential predators to their stock was to bait carcasses with strychnine, cyanide or other poison. If condors came to feed at such carcasses, they too would be killed. In addition, widespread hunting un-

doubtedly meant that many deer were wounded, and would subsequently die with lead bullets or shot in their bodies. When condors came to feed on such carcasses they would eat the lead and be poisoned. Condors are birds which are adapted for an environment in which adult mortality is very low. Adult birds would probably have had among the longest lifespans of any bird species. Their reproductive rate was also extremely low, with a maximum rate of one chick every two years. In the undisturbed environments in which the birds evolved, the rate at which young were produced could balance the rate at which adults were dying. But modern man introduced a whole new range of dangers for the condors, and far more birds were dying each year. Unfortunately, the birds could not increase their rate of chick production to compensate, and so were steadily sliding to extinction.

The fight to save the California Condor is a remarkable story, and the accounts given by the Snyders should be read by anyone with an interest in wildlife conservation. Endangered species programmes often involve problems of politics, policy disagreements and bureaucracy that are every bit as important as the scientific research. This has certainly been true for the Condor Programme.

It has always been extremely difficult to collect good field information on the condors, and to identify the cause of the population decline. Despite several excellent scientific studies, by 1980 there was even disagreement over the number of condors still surviving. Several attempts at management of the population had not prevented a continuing decline in numbers. An intensive research programme was then initiated to obtain better information. This included catching birds to attach small radio transmitters, so that their movements could be followed. This was not only to reveal information on their use of the habitat, but also to enable any birds which died to be recovered so that the causes of mortality could be identified. It was also intended to start a captive breeding programme, by catching some immature birds, which, when they started breeding, would provide young birds to release and reinforce the wild population.

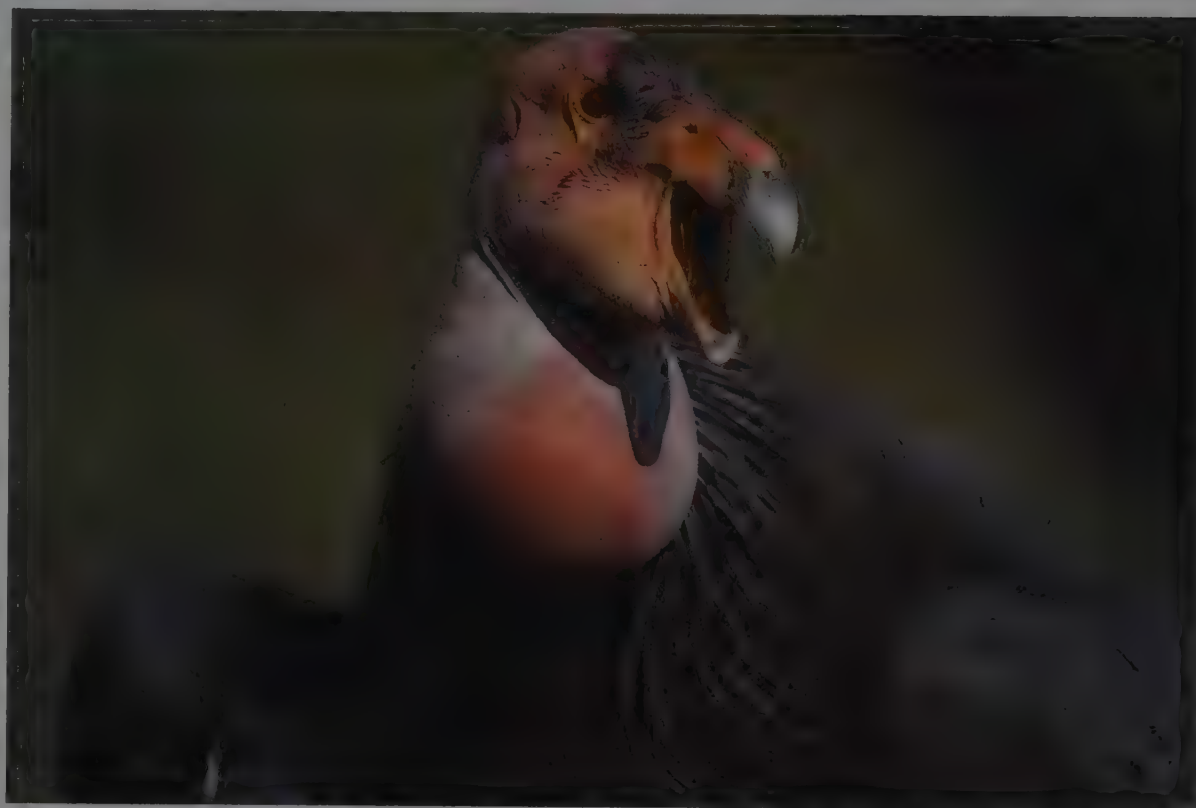


The American Black Vulture is the most gregarious member of the family at carcasses. Here, large numbers have gathered alongside many Crested Caracaras (*Polyborus plancus*), and both species are feeding on a heap of capybara (*Hydrochaeris hydrochaeris*) carcasses, all that is left over after one of the traditional round-ups of these giant rodents on the Venezuelan llanos. This is just one of the many examples of how man's activities have benefited the American Black Vulture, which is, for instance, also a regular visitor to rubbish dumps. A direct result of this tendency is that the species is now much more common in habitats altered by man than it is in undisturbed ones.

[*Coragyps atratus*
brasiliensis,
in llanos of Venezuela.
Photo: Adrian Warren/
Ardea]

The campaign to save the California Condor must undoubtedly be the most complex and expensive such programme ever carried out for a species of bird. By 1982, the total population had slumped to only 21 birds, and the species actually became extinct in the wild in 1987, as it was decided to bring all the remaining wild birds into captivity. After remarkably successful captive breeding, the species was reintroduced, with the first two birds released into the wild in 1992. Clearly visible in this photo is the inflatable neck pouch, which, as in some storks, for instance the Jabiru (*Jabiru mycteria*), plays an important part in courtship display.

[*Gymnogyps californianus*.
Photo: Ron Austing/FLPA]



These studies revealed that in the early 1980's the total population was around 20 birds and still declining, and contained only four or five breeding pairs. Also of vital importance was the discovery of the cause of death of four birds, recovered because of their radio transmitters. Three had died from lead poisoning and one from cyanide. The few birds which were still breeding, however, seemed to have satisfactory levels of breeding success. Attitudes to the intensive research programme rapidly polarized around two irreconcilable viewpoints. One approach maintained that the condors were extremely sensitive to disturbance, particularly around the nest-site, and that their best hope of recovery lay in minimal disturbance. A second opinion was that the number of birds was now so critically low, and the mortality rate so high, that the species needed active management, including the development of an intensive captive breeding programme. While these arguments were debated endlessly among conservation agencies and through the lawcourts, the condors continued to die.

Finally, the decision was taken to capture all the remaining wild condors, and this was achieved by 1987. The future of the species then lay in the captive breeding efforts of the Zoological Societies of Los Angeles and San Diego, and later also the Peregrine Fund at Boise, Idaho. One of the key pieces of information derived from the field research was that the condors would relay if the first egg was lost. This fact, which was hardly surprising, since it had been known for many years that Andean Condors would relay in this way, had been considered impossible by some people. From the start of the breeding programme, therefore, captive pairs of California Condors have always had their eggs removed for artificial incubation, and in this way two or three eggs can be obtained from each pair. Fortunately for the condors, as well as having had extremely dedicated field researchers to highlight their problems in the wild, they were now entrusted to two outstanding teams of zoo staff. The commitment and skill shown by the zoos in building up the captive population have been really remarkable, and the hatching success and survival of the captive population is extremely high. Equally importantly the Condor Programme has benefited from much recent work on understanding the genetic management of small populations, to minimize the loss of genetic diversity among the birds.

Release of young California Condors back into the wild started in 1992. Already some young birds have been found dead, through collision with power lines and poisoning, which indicates that much work remains to be done on restoring the environment for the birds. Maybe the future for the condors will lie in also releasing birds in other sites in North America where fewer hazards face them. This will give time to correct the obvious problems in their original range. The future for the California Condor is now getting brighter. The numbers are increasing fast, probably for the first time for hundreds of years. Provided the captive breeding programme can be sustained, an increasing number of birds will become available for release each year.

The crisis facing the California Condor has also stimulated much research on Andean Condors. This species was initially used as a model to develop methods of captive breeding, rearing of the young and to develop the best methods for release of birds back into the wild. M. P. Wallace started a programme of releasing Andean Condors in Peru, and then later went on to help develop a release programme for Andean Condors into the former range of the California Condors. This was to study the movement patterns they developed, and find the best ways to support released birds with feeding stations. These birds were later all recaptured, before being replaced by the young California Condors, and taken down to Colombia and Venezuela to reintroduce populations in areas where the birds had become extinct. We have little good information on the status of Andean Condors. There is no doubt that their range has contracted markedly in recent years, and they are now rarely seen in the northern Andes. There appear to be good numbers of birds still to be seen in some parts of Peru and Chile, but we know nothing of the population dynamics of these birds, and there is an urgent need for study of these aspects. It is undoubtedly a vulnerable species, which is likely to need active conservation management in the future.

General Bibliography

Amadon & Bull (1988), Brown & Amadon (1968), Feduccia (1980), Ligon (1967), Sibley & Ahlquist (1990), Sibley & Monroe (1990), Sibley *et al.* (1988), Smith (1985), Stager (1963), Stresemann & Amadon (1979), Wilbur & Jackson (1983).



ssp. aura

1



3



ssp. ruficollis



2



5



4



6



♂



♀

7

PLATE 1

inches 16
cm 40

Genus *CATHARTES* Illiger, 1811

1. Turkey Vulture

Cathartes aura

French: Urubu à tête rouge

German: Truthahngerier

Spanish: Aura Gallipavo

Taxonomy. *Vultur aura* Linnaeus, 1758, Veracruz, Mexico.

Taxonomic status of all three *Cathartes* species rather uncertain: some forms currently considered races of present species may yet prove to merit treatment as full species. N populations of nominate race sometimes placed in separate race, *meridionalis*; those of Falkland Is and W South America sometimes separated off in race *falklandicus*; however, some variation clinal, and in general subject still poorly known (see page 25). Four subspecies usually recognized.

Subspecies and Distribution.

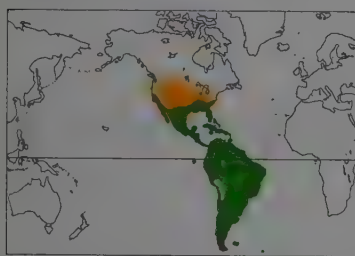
C. a. aura Linnaeus, 1758 - W North America S to Costa Rica; Greater Antilles.

C. a. septentrionalis Wied, 1839 - E North America.

C. a. ruficollis Spix, 1824 - S Central America (from Costa Rica S) and lowland South America; Trinidad.

C. a. jota (Molina, 1782) - Pacific coast of South America (from Ecuador S), E Andes, Patagonia, Falkland Is.

Introduced (nominate *aura*) to Puerto Rico.



Descriptive notes. 64-81 cm; 850-2000 g; wingspan c. 180-200 cm. Size variable. Brownish black, with only slight iridescence on plumage. Head and neck bare, sometimes with whitish warts and patches of bristles. Skin colour variable, from pink to bright red. Juvenile birds are duller brown in plumage, and have dark grey skin colour on head, with short downy feathers. Species shows cline in body size, and distinction between subspecies is largely on size and intensity of colouring of head; race *ruficollis* distinctive, with whitish band across back of head.

Habitat. Found in an extreme range of habitats, from total desert in coastal Peru, through grasslands and savannas, into dense tropical rain forest, and temperate woodland in North America. Does not associate with man in the manner of *C. atratus*; small numbers may collect around rubbish dumps. Wanders up to 4300 m.

Food and Feeding. A more exclusive scavenger than *C. atratus*, rarely killing even small prey items, and relying on finding carcasses. Even attracted by carcasses of small birds, but main prey is medium-sized mammals. In disturbed environments benefits greatly from road kills, and this source of food may account for northern extension of distribution of species that has occurred during present century. Food located by olfaction, and this genus is one of the few among birds in which sense of smell is highly developed and plays major role in locating food. Freshly dead carcasses do not emit strong enough smell to attract birds, but in tropical conditions carcasses one day old are located with great efficiency. Birds tend to ignore carcasses that are many days old, probably to avoid toxic by-products of bacterial action. At carcasses, present species tend to be timid, and usually dominated by both *C. melanobrotus* and *Coragyps atratus*. Usually arrives at carcasses first, withdraws while other species feed, and then returns to clean up after other birds have left.

Breeding. Well studied in North America, very poorly known in tropical areas. Egg-laying in March in Florida, May-Jun further N; Feb-Apr in Panama; Dec-Mar in Cuba. Nests in shallow caves, on ground in dense undergrowth, or in hollow tree stumps and logs; no nesting material provided. 2 eggs; incubation 38-41 days; chicks have white down, and dusky, bare head; fledging at 70-80 days or more.

Movements. North American races migratory, moving to S USA and funneling through Central America into N South America, and possibly S to Paraguay.

Status and Conservation. Not globally threatened. Widespread and abundant. Huge numbers migrate through Central America, with over 230,000 counted over Panama City in Oct-Nov 1973; also c. 1,000,000 recently over Veracruz (E Mexico). Rather common below 2500 m on E Andes, from S.W. Bolivia to WC Argentina, and also in steppe areas of Patagonia. Range has increased recently, and it is known that birds are more abundant in disturbed than in undisturbed habitats. Not seriously persecuted anywhere in range. Introduced to Puerto Rico (from Cuba) in 1880.

Bibliography. Arad *et al.* (1989), Audubon (1826), Bang (1972), Blake (1977), Brown, W.H. (1976), Clark & Ohmart (1985), Coleman & Fraser (1987), Coles (1938, 1944), Contreras *et al.* (1990), Davis (1979), Fjeldsá & Krabbe (1990), Friedmann (1950), Hatch (1970), Hiraldo, Delibes & Donazar (1991), Houston (1985, 1986, 1988), Johnson (1965), Lemon (1991), Lever (1987), Monroe (1968), Owre & Northington (1961), Palmer (1988), de la Peña (1992), Root (1988), Sick (1985a, 1993), Slud (1964), Smith (1980), Snyder & Snyder (1991), Stager (1964), Stewart (1977), Tostain *et al.* (1992), Vogel (1950), Wallace & Temple (1983), Wetmore (1964, 1965), Wilbur & Jackson (1983), Work & Wool (1942).

2. Lesser Yellow-headed Vulture

Cathartes burrovianus

French: Urubu à tête jaune

German: Kleiner Gelbkopfgeier

Spanish: Aura Sabanera

Other common names: Savanna (Yellow-headed) Vulture

Taxonomy. *Cathartes burrovianus* Cassin, 1845, near Veracruz City, Mexico.

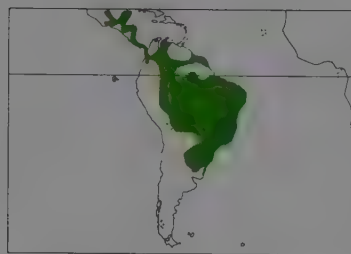
Taxonomic status of all three *Cathartes* species rather uncertain. Present species has been placed in superspecies with *C. melanobrotus*, but the two are widely sympatric. Formerly called *C. urubitinga* or *C. urubitinga*. Two subspecies sometimes recognized.

Subspecies and Distribution.

C. b. burrovianus Cassin, 1845 - Central America S to C Colombia and NW Venezuela.

C. b. urubitinga Pelzeln, 1861 - lowland South America.

Descriptive notes. 58-66 cm; 950-1550 g; wingspan c. 160 cm. Plumage black. Bare skin on head and neck seems to vary considerably in colour: some birds have pure bright yellow, others also



have orange and blue tones. Immature browner, with dusky head and whitish nape. Races differ only in size.

Habitat. Most records come from flat, grasslands, llanos and savannas. Will enter forests, but usually only at forest edge.

Food and Feeding. Feeding ecology very similar to that of *C. aura*. Has good sense of smell, which it uses to locate food. Probably feeds on wide range of small prey items.

Breeding. Very little information available. Adult seen with two recently fledged young in May in Colombia; in same country, female ready to lay in Aug. Nesting reported in holes

in large trees, Surinam.

Movements. No evidence to suggest any extensive movements, but abundance may vary seasonally in Panama and Venezuela.

Status and Conservation. Not globally threatened. Status and distribution poorly known, but seems to be widespread and relatively numerous. Fairly common to common in suitable habitat in Panama and Colombia, outnumbering *C. aura* at Carimagua, Meta (C Colombia). Common along coastal parts of French Guiana. In Brazil, most common in NE and Amazonia. No threats known.

Bibliography. Belton (1984), Blake (1977), Contreras *et al.* (1990), Houston (1988), Kirk (1988), Koster (1982), Lemon (1991), Monroe (1968), de la Peña (1992), Shuker (1993), Sick (1985a, 1993), Slud (1964), Tostain *et al.* (1992), Wetmore (1964, 1965).

3. Greater Yellow-headed Vulture

Cathartes melambrotus

French: Grand Urubu

German: Großer Gelbkopfgeier

Spanish: Aura Selvática

Other common names: Forest (Yellow-headed) Vulture

Taxonomy. *Cathartes melambrotus* Wetmore, 1964, Kartabo, Guyana.

Taxonomic status of all three *Cathartes* species rather uncertain. Present species very similar in appearance, ecology and behaviour to *C. aura* and *C. burrovianus*. Has been regarded as an allospecies of *C. burrovianus*, but the two have widely sympatric ranges. Monotypic.

Distribution. Poorly known. Amazonia, including S Venezuela and the Guianas. Knowledge of distribution is likely to be conservative.



Descriptive notes. 74-81 cm; 1650 g. Plumage black, with clear iridescence on the back and coverts. Skin colour of head bright yellow, shading to bright orange on neck, and to blue on top of head. Very similar in appearance to *C. burrovianus*, from which not easy to distinguish, but tail noticeably longer; present species has greater wing and tail area.

Habitat. Seems to be confined to undisturbed lowland tropical forest in South America, and does not occur in more open habitats. Not found in disturbed forests.

Food and Feeding. Scavenger on carcasses of forest mammals, such as monkeys, sloths

and opossums. Locates food in similar manner to *C. aura* in forests, flying low over forest at height of tree canopy to detect scent of carrion, then descending to the food by following scent trail. Occurs in some areas sympatrically with *C. aura*, over which it is dominant at carcasses.

Breeding. Virtually no information available, no nest having been found. Copulation seen in Aug, French Guiana.

Movements. No information available.

Status and Conservation. Not globally threatened. Apparently confined to remote areas, and not found where forests have been disturbed. Commonest vulture away from humanized areas in Amazonian Colombia. In French Guiana, common in undisturbed forest, but becoming less frequent in areas where food supply impoverished by heavy hunting pressure.

Bibliography. Bernal *et al.* (1994), Blake (1977), Fjeldsá & Krabbe (1990), Graves (1992), Hero *et al.* (1992), Houston (1994), Shuker (1993), Sick (1985a, 1993), Tostain *et al.* (1992), Wetmore (1964).

Genus *CORAGYPS*

I. Geoffrey Saint-Hilaire, 1853

4. American Black Vulture

Coragyps atratus

French: Urubu noir

German: Rabengeier

Spanish: Zopilote Negro

Other common names: Black Vulture

Taxonomy. *Vultur atratus* Bechstein, 1793, St John's River, Florida.

Affinities unclear. May be better considered monotypic, as validity of races doubtful. Three subspecies sometimes recognized.

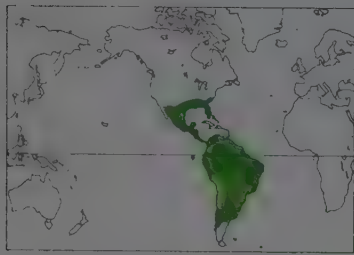
Subspecies and Distribution.

C. a. atratus (Bechstein, 1793) - S USA and N Mexico.

C. a. brasiliensis (Bonaparte, 1850) - Central America and N & E South America.

C. a. foetens (Lichtenstein, 1817) - W South America.

Descriptive notes. 56-68 cm; 1100-1900 g; wingspan 137-150 cm. Dull black, with only slight iridescence on wings and tail. Primary feathers have a light grey ventral side, which forms



penetrating far into dense, undisturbed forests.

Food and Feeding. A general scavenger, taking almost any animal food, e.g. insects, birds' eggs, fish; frequents small and large animal carcasses, where collects in large numbers. Has a markedly larger gape than *Cathartes* vultures, and at carcasses specializes in muscle and viscera, which it can gulp down rapidly. Does not have ability to smell, so in forest conditions is dependent on *Cathartes* species to be led to food. Also regularly kills small items of prey, such as nestling birds and hatching sea turtles; can catch live fish, insects, small reptiles, etc. Dominant over *Cathartes* species, especially when present in large groups, and tends to displace them from carcasses. Known to forage in family groups.

Breeding. Laying dates very variable: in Ohio (USA), Mar-May; in Panama Oct-Dec; in Colombia May-Nov. Nest-site variable: in shallow caves; between boulders in rocky outcrops; on ground at base of tree; or in hollow stumps. No nesting material provided. 2 eggs; incubation, by both parents, 38-45 days; chicks have rich buff-coloured down, with head bare; regularly wander from nest-site towards end of nestling period; fledging probably at c. 3 months. Young remain with parents, and continue to forage with them in social groups, probably for many years.

Movements. Unlike *C. aura*, birds in North America seem largely resident. Some birds pass through Panama following the main raptor migration, perhaps suggesting some local seasonal movements. In tropical habitats, birds are probably mainly resident, and marked individuals known to have remained at same site throughout year.

Status and Conservation. Not globally threatened. Widespread and common; has undoubtedly benefited from human activities, and now far more abundant in disturbed habitats than in natural wildlife areas. Suffers occasional persecution, because of suspected transmission of human diseases, e.g. salmonella, and diseases of cattle.

Bibliography. Bang (1972), Bent (1937), Blake (1977), Brown, W.H. (1976), Coleman & Fraser (1987), Contreras *et al.* (1990), Fjeldså & Krabbe (1990), Friedmann (1950), Johnson (1965), Lemon (1991), Ligon (1967), McHargue (1981), Monroe (1968), Palmer (1988), Parmalee (1954), Parmalee & Parmalee (1967), de la Peña (1992), Rabenold (1986, 1987a, 1987b), Root (1988), Sick (1985a, 1993), Slud (1964), Snyder & Snyder (1991), Stewart (1974, 1978, 1983), Thomas (1928), Tostain *et al.* (1992), Wallace & Temple (1983), Wetmore (1965), Wilbur & Jackson (1983).

Genus *SARCORAMPHUS* Duméril, 1806

5. King Vulture

Sarcoramphus papa

French: Sarcoramphé roi

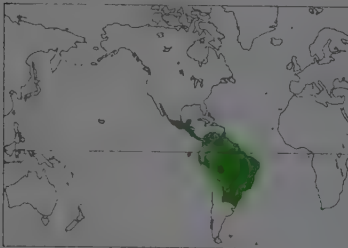
German: Königsgeier

Spanish: Zopilote Rey

Taxonomy. *Vultur papa* Linnaeus, 1758, "in India occidentali"; error, Surinam.

Affinities unclear. Monotypic.

Distribution. Tropical forest and savanna regions of Central and South America, from Mexico to N Argentina.



ly over about four years.

Habitat. Lowland tropics, usually associated with undisturbed forest, but also found in open savanna and grassland habitats.

Food and Feeding. A scavenger, usually associating with *C. aura* or *C. melambrotus*. Does not appear to have functional sense of smell, and so is dependent on *Cathartes* vultures to lead it to food. At carcasses, large size and powerful bill enable it to tear open skin of larger mammals that can not be opened by smaller forest vulture species. Dominant over other species, but usually not aggressive when feeding, and will tolerate other species feeding alongside. Usually only one or two adults come to carcasses, together with young birds, suggesting that species may be territorial in feeding. At large carcasses, groups of ten or more adults can be found, although it is unusual for more than two adults to feed together. Comparatively small gape, and feeds rather slowly, taking skin and tougher items of tissue from a carcass.

Breeding. Only a few nests have been found; insufficient information available from the field to describe breeding season or biology, but species breeds well in captivity, from which there is good information on courtship and breeding behaviour. In wild, nests on ground or in stumps of trees, on one occasion perhaps considerably above ground level; no nesting material collected. 1 egg; incubation 53-58 days, in some pairs shared equally by the sexes, in others carried out entirely by female; chick covered in pure white down; regularly wanders away from nest-site as it develops. Development in captivity suggests fledging at c. 3 months, young closely attended by parents long after this.

conspicuous whitish patch on underside of wing in flight. Head bare, with numerous folds of skin, and warty texture. Juveniles similar, but with less skin folding on head and some downy feathers. Races differ in extent of pale area on underwing, and also in size.

Habitat. Closely associated with human activity, and abundant around many cities, feeding on refuse and road kills. Some cities in Central and South America have vast numbers collecting around markets, fish docks and garbage dumps. Otherwise found almost everywhere in lowland habitats, especially along rivers and in open country; rarely found

Family CATHARTIDAE (NEW WORLD VULTURES) SPECIES ACCOUNTS

Movements. Apparently resident in most areas throughout the year.

Status and Conservation. Not globally threatened. Very little information available. Although a very striking bird, it is rarely seen; usually perches high in forest canopy, and flies very high when searching for food, making presence in an area often inconspicuous. Status best determined by laying out carcass baits to attract birds to the ground; using this system, several areas where birds unrecorded for some years have been shown to have healthy populations. Species can survive in areas of cattle ranching, presumably provided it has access to some undisturbed forest areas for breeding. In forests seems to be particularly susceptible to human disturbance, and rarely recorded in areas where mammal populations have been reduced. CITES III in Honduras.

Bibliography. Antas & da Silveira (1980), Berlanga & Wood (1992), Blake (1977), Clinton-Eitnincar (1981, 1987), Contreras *et al.* (1990), Cuneo (1968), Fjeldså & Krabbe (1990), Friedmann (1950), Kirk (1988), Koster & Koster-Stoewesand (1978), Heck (1963, 1971), Houston (1984, 1988), Lemon (1991), Lundy (1957), Monroe (1968), Palmer (1988), de la Peña (1992), Reid (1989), Schlee (1987), Sick (1985a, 1993), Slud (1964), Smith (1970), Thiollay (1985b, 1989b), Tostain *et al.* (1992), Wetmore (1965), Zwart & Louwman (1980).

Genus *GYMNOGYPS* Lesson, 1842

6. California Condor

Gymnogyps californianus

French: Condor de Californie

German: Kalifornischer Kondor

Spanish: Cóndor Californiano

Taxonomy. *Vultur californianus* Shaw, 1798, Monterey, California.

At one time placed in genus *Pseudogryphus*. Monotypic.

Distribution. Extinct in wild from 1987 to 1992. Captive population now being used for reintroduction to former range, in hills around San Joaquin Valley, California. Formerly occupied mountain tops of Pacific coast of North America.



Descriptive notes. 117-134 cm; 8000-14,000 g; wingspan c. 270 cm. Black plumage, with white underwing-coverts. Long ruff feathers also black. Head and neck bare with variable pink-orange and red colours. Immature has bare skin grey.

Habitat. Within recent times range restricted to remote, irregularly wooded hills north of Los Angeles, California. During Pleistocene, species was widespread across much of North America, and must have occupied a wide range of prairie, mountain and hillside habitats.

Food and feeding. Scavenger on carcasses of large mammals. When species was still abundant, large groups of birds could be attracted to feed at a single carcass.

Breeding. Egg laid Feb-May. Nest-site usually in caves or large tree holes; no nest construction. 1 egg; incubation c. 55-60 days; chick has first down white with bare pink to yellow head, then second down grey also covering head; fledging c. 6 months, but still fed by parents for several months afterwards. If breeding successful, pair will not breed in subsequent year. Adult plumage not attained until 5 or 6 years old, and sexual maturity at c. 8 years old. Known to live up to 45 years old.

Movements. Radiotelemetry studies show that most breeding birds travelled about 30 km to reach feeding sites. Not known to undertake long distance movements.

Status and Conservation. ENDANGERED. CITES I. One of the most seriously endangered of all bird species. Population has been declining throughout present century. First detailed study estimated 60 birds alive in 1953; by 1982, numbers had fallen to 21 birds in the wild. Intensive research programme demonstrated that remaining birds had satisfactory breeding output, but that increase in mortality was responsible for the population decline. Causes of mortality were difficult to identify, but shooting, lead poisoning, strychnine poisoning, collision with power lines, electrocution and soilage in tar and oil deposits were probably involved. Disagreement between conservation agencies and consequent legal disputes delayed the implementation of effective recovery programme until so late that captive breeding was the only realistic chance of saving the species. In 1987 it was agreed that all wild birds would be caught and taken into two captive breeding facilities provided by the Zoological Societies of Los Angeles and San Diego. Captive breeding has been highly successful: captive population up to 52 birds by 1991; 15 chicks hatched in 1993; and first 2 young birds released back into the wild in 1992.

Bibliography. Bruning (1983a), Collar & Andrew (1988), Collar *et al.* (1992), Cox *et al.* (1993), Emslie (1987), Finley (1906-1910), Friedmann (1950), Janssen *et al.* (1986), Kiff (1983, 1990), King (1978/79), Kotford (1953), Meretsky & Snyder (1992), Palmer (1988), Puttee (1987), Root (1988), Snyder (1983), Snyder & Hamber (1985), Snyder & Johnson (1985), Snyder, Johnson & Clendenen (1987), Snyder, Ramey & Sibbey (1986), Snyder & Snyder (1989, 1991), Steadman & Miller (1987), Toone & Risser (1988), Wallace, M.P. (1989, 1991), Wallace & Temple (1983, 1987b), Wallace & Toone (1992), Wilbur (1978).

Genus *VULTUR* Linnaeus, 1758

7. Andean Condor

Vultur gryphus

French: Condor des Andes

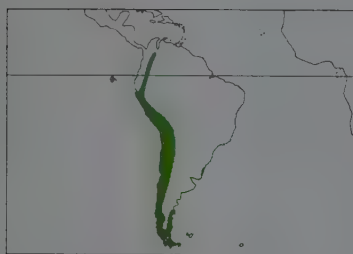
German: Andenkondor

Spanish: Cóndor Andino

Taxonomy. *Vultur gryphus* Linnaeus, 1758, Chile.

Monotypic

Distribution. Andes, from Venezuela to Tierra del Fuego, descending to sea-level in Peru and Chile.



Descriptive notes. 100-130 cm; female 8000-11,000 g, male 11,000-15,000 g; wingspan up to 320 cm. The only American vulture to show sexual dimorphism: male has large comb and large neck wattles, lacking in female. Plumage black, with secondaries and upperwing-coverts greyish white. Conspicuous white neck ruff. Bare skin on head and neck variable in colour, reddish pink at base of neck, more mottled greyish pink or yellow on head. Juvenile dull brown, with dark bare skin; over years adopts blacker plumage, with white neck ruff only appearing in adults.

Habitat. Mainly high mountains, including highest peaks, but usually over open grassland and alpine regions, away from human disturbance and where carrion can be found: rare in forested areas. Descends to lowland desert regions in Peru and Chile, especially to forage along the shoreline for stranded whales, seals and seabirds; also on grassland plains of Argentina S of Río Negro.

Food and Feeding. Mainly carrion from large and medium-sized mammals, such as guanacos (*Lama guanicoe*), domestic livestock or marine mammals along coast. Will also take smaller food items, including eggs from seabird colonies. Powerful bill capable of tearing skin and extracting muscle and viscera from carcasses. Up to 40 birds seen together at a large carcass.

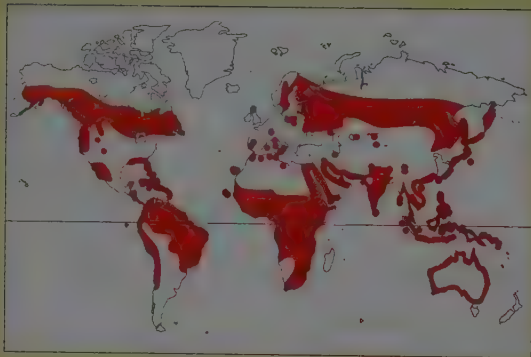
Breeding. Poorly known. Laying Feb-Jun in Peru, Sept-Oct in Chile. Nests in shallow caves on cliff ledges. 1 egg; incubation c. 59 days (in captivity); chick grows slowly and is fully-feathered and capable of flight at 6 months, but parental care continues long after fledging, so whole breeding season lasts over 12 months. Breeding probably only occurs in alternate years, and many pairs may not breed at all when feeding conditions are poor. Young birds do not attain adult plumage till 6 years old, and in captivity breeding may be delayed several years further.

Movements. Forages very widely, and must cover great distances. Appears to be resident throughout the year, with no evidence of migrations.

Status and Conservation. Not globally threatened. CITES I. Poorly known, but currently threatened over most of range. Now exceedingly rare in N of range, in Venezuela and Colombia; reintroduction programme using captive-bred birds currently under way in Venezuela and Colombia. Most frequently seen in Peru, Chile, and Argentina, where in some areas species remains common. Still subject to persecution and poisoning over most of range, because of alleged attacks on livestock. Status of remaining population is difficult to determine, because so little known about mortality, breeding frequency and success. Species clearly adapted for exceptionally low mortality and low reproductive output, so highly vulnerable to human persecution. There is serious need for detailed study of population dynamics of this species, to determine its conservation status. Protected under CITES due to pressure from live animal trade.

Bibliography. Andrews (1982), Blake (1977), Calchi & Vilorio (1991), Fjeldså & Krabbe (1990), Gailey & Bolwig (1973), Hilty & Brown (1986), Jaksic & Jiménez (1986), Johnson (1965), McGuhan (1972), Pennycuik & Scholey (1984), de la Peña (1992), Sick (1985a, 1993), Temple & Wallace (1989), Wallace, M.P. (1985, 1989), Wallace & Temple (1987a, 1987b, 1988), Zonfrillo (1977).

Class AVES
Order FALCONIFORMES
Suborder ACCIPITRES
Family PANDIONIDAE (OSPREY)



- Large piscivorous birds of prey, with reversible outer toe and spiny foot pads to help grasp slippery prey.
- 55-58 cm.



- Cosmopolitan.
- Shallow waters, both inland and marine.
- 1 genus, 1 species, 4 taxa.
- No species threatened; none extinct since 1600.

Systematics

The Osprey (*Pandion haliaetus*) is generally placed in a monospecific family within the suborder Accipitres, which contains the hawks, the Old World vultures, and the eagles. Still debated is whether this fish hawk is different enough from other birds of prey to warrant such separate treatment, or whether it simply deserves subfamily status within the family Accipitridae. DNA-DNA hybridization studies have suggested the latter, but more work is needed to clarify this.

In essence, this is a hawk that has evolved as a fishing specialist, and its differences from members of the Accipitridae reflect adaptations to its unique way of life. Prominent among these adaptations are: a reversible outer toe and spiny foot pads, which serve as aids to carrying and gripping slippery fish; a long small intestine, as in other fish-eating birds, probably helping it to digest fish, bones and all; dense, compact, oily plumage; long, sharp, curved claws; and nasal valves that help shut out water when the bird dives. In addition, the Osprey has a narrow head and lacks the bony ridges above the eyes seen in many hawks and eagles, giving it an almost feline look when perched. In the air, it both hovers and soars well, but it can also fly long distances directly across water and deserts in steady, powered flight (see Movements). Its wings are relatively long and narrow, a compromise between efficient soaring and manoeuvrability.

The Osprey's fossil record, which dates back at least to the middle of the Miocene, 10-15 million years ago, suggests the species has changed little since then. And later Miocene and Pleistocene fossils from western Europe, North America, and the Bahamas indicate a range essentially unchanged from that of today.

Four Osprey subspecies are recognized nowadays: nominate *haliaetus* from the Palearctic; *carolinensis* from North America; *ridgwayi* from the Caribbean subregion; and *cristatus* from coastal Australia, and a broad arc of islands stretching north and east of the continent, from Sulawesi and Java to New Caledonia. The latter two subspecies are composed of non-migratory, resident populations, while the first two contain both migrants and residents, depending on latitude of breeding (see Movements). The four subspecies differ little, mainly in plumage and size, and sexual differences confuse the issue, as, in all populations, males tend to be paler in their breast plumage and smaller in body mass and wing (see Morphological Aspects).

The lack of speciation among Ospreys is interesting, and contrasts markedly with the *Haliaeetus* sea-eagles (see page 54), which have formed eight distinct species over a range nearly identical to that of the Osprey. These eagles differ from Ospreys, however, in their migration patterns, as most are residents or short distance migrants. Because Ospreys are long distance migrants (see Movements), there is more chance for interchange among populations and thus less chance for subspecies to become isolated as distinctive species.

Morphological Aspects

Ospreys vary in size both geographically and by sex. In any one population, females are larger than males, averaging about 20% larger in body mass, and 5-10% larger in wing length. Some overlap is possible, but this is limited; in North America, for example, nearly all males weigh less than 1600 grams, while nearly all females weigh more. Yet at a distance such differences are obscured and it is often difficult to distinguish between the sexes in the field, even though females tend to have darker breast plumage. Such reversed size dimorphism is typical in birds of prey, but the factors selecting for it are still debated. Large size confers some obvious advantages to a female, for example in terms of nest defence, egg production, and incubation efficiency, but male Ospreys help considerably with both defence and incubation (see Breeding).

In both sexes, Ospreys that breed in tropical and subtropical climates tend to be smaller than those breeding at cooler, higher latitudes. Australasian Ospreys, for example, are 12-14% smaller in wing length than their Palearctic counterparts, while Caribbean Ospreys average about 5% smaller than New England Ospreys. Such shifts along a climatic gradient are thought to have adaptive significance: among warm blooded vertebrates, races in cold climates tend to have larger bodies than those in warm climates, because larger bodies retain heat more efficiently.

In plumage, the sexes are quite similar, although females in any one race tend to be darker on the breast and often on the head. Overall, for both sexes, the Osprey's salient features are its bright white underparts, with a mottled brown breast band of variable intensity, the pronounced crook in its long wings, which in flight are bent back at the "wrists" or carpal joints, its dark carpal patches contrasting with pale underwing-

The Osprey's wings are long and rather narrow, and they are sharply angled at the carpal joints in flight. It flies alternating powerful wingbeats with short glides. Its wing structure allows it to undertake long distance migrations over water and deserts, without showing the dependence on thermals and other natural updraughts that characterizes many broad-winged, soaring raptors. The strikingly white underparts, contrasting with the darker wing feathers and tail, the dense black carpal patches and the broad black line through the eye to the hindneck are the species' most distinctive field characters.

[*Pandion haliaetus*.
Photo: François Gohier/
Ardea]



coverts, and the dark stripe through its eye. The upperparts of northern birds are a rich dark chocolate brown, the flight-feathers pale grey, and the undertail white with narrow dark barring. The subspecies show only slight differences, mostly in plumage and size, with *haliaetus* and *carolinensis* the largest and darkest, and *ridgwayi* essentially a pale form of *carolinensis*. The Australasian *cristatus* is a small Osprey with a dark breast band and a relatively pale crown. In all races, juveniles resemble adults in terms of plumage, but they are somewhat paler above, the feathers edged with buff, and the breast band less sharply defined. At all ages, the feet are a pale blue-grey, and the bill is black.

The Osprey's adaptations for fishing include relatively long legs for a raptor of its size, and these enable the bird to extend its reach for fish under water. Other such notable developments are spiny foot pads and a reversible outer toe to help grasp slippery prey, dense, oily plumage, and efficient nasal valves that prevent water entering the nostrils when the bird dives. Its wings are relatively long and narrow, much like a harrier (*Circus*), with moderate wing-loading. This is a style of wing evolved for efficient hovering or direct flight, rather than primarily for soaring, although Ospreys can and do soar, especially in the middle of the day. As a result of this structure, the species is an efficient migrant over water and deserts, and is suitably built for long distance travel (see Movements). Unlike many broad-winged raptors, notably those of the genus *Buteo*, this is not a species dependent on landforms, such as ridges that produce updraughts, or thermals, or other features which can play an important part in the migration of soaring hawks.

Among migrant populations, the moult of the primaries proceeds in successive waves, starting from the innermost and working its way outwards. Generally, at least three intact feathers remain between centres of new growth, preserving much of the flight efficiency of the wing. Nevertheless, among migrants, moult stops during both northward and southward migration. Roughly half of the adult birds moult on their breeding grounds, generally in late summer towards the end of breeding, but virtually all adults moult in their wintering grounds. Such wave moult ensures that all the flight-feathers are replaced in one year. Moult of non-migratory Ospreys has not been studied.

Habitat

Breeding Ospreys inhabit a broad array of coastal habitats, along lakes, reservoirs, marshes, bay and sea shores, and to a lesser extent rivers. Shallow water is generally the common denominator here, because fish are easier to find and catch in the shallows than in deep water (see Food and Feeding).

The other key limiting factor for this species is the availability of safe, predator-free sites for the bulky stick nest. Shoreline trees, generally dead ones, occasionally provide good sites, but the vast majority of such trees are unable to support the Osprey's sizeable nest or, just as important, are accessible to climbing predators. Small islands, by contrast, usually have few or no ground predators, and so are favoured nesting habitat. In some places, pairs breeding on small islands will even nest on the ground, for instance in Australia and north-west Mexico. Likewise, trees killed when flooded out by beavers (*Castor*) or by man's reservoirs, natural swamps, and also overwater structures, like buoys and channel markers, provide safety by isolating nests from shore. All these island and overwater situations promote the largest and densest colonies of nesting Ospreys.

The species has several typical habitats, which vary to a certain extent regionally. Salt marshes are commonly used in the north-eastern USA, the birds fishing in the surrounding tidal creeks and rivers, in bay waters, and along the nearby ocean shoreline; in this region, pairs nest increasingly on artificial platforms. Mangrove (*Rhizophora*) swamps are important habitat in southern Florida, Cuba and Belize, and also along the Red Sea and sometimes in Australia, with birds nesting in the tops of mangroves, or on the ground on open islands. In the Carolinas of the eastern USA, in cypress (*Taxodium*) swamps, nests are built over the water in the tops of these trees, while the birds commute to nearby marine bays and estuaries to feed. In Sweden, Canada and Russia, typical nesting habitat comprises lakes with shallow waters and islands in the boreal forest, and also bogs. Scattered pairs nest in tall trees along the shoreline of such lakes, or in smaller trees on islands; in these areas, a late break-up of the ice often delays breeding. In the western USA, birds occupy reservoirs, rivers, often those with anadromous fish, and lakes; fish released by hatcheries often form a key part of the diet. In Scotland, birds breed beside lochs or rivers, with nests in nearby pines, or on small islands; there are a few coastal pairs. Finally, Mediterranean birds occupy cliff nests on rocky islands.

General Habits

For breeding Ospreys can be solitary or form loose colonies. They may nest dozens of kilometres from their nearest neighbours, or, at the other extreme, 30-40 pairs within an area of just half a square kilometre. As many as 200-300 pairs may breed on an island only 700 ha in size, with most of them concentrated in just a few sectors. Such coloniality is unusual for a raptor but typical for a fish-eating bird; fish are a mobile resource, hard to defend, so there is no reason for an Osprey to defend anything but its immediate nest-site.

Defence of nests can be intense, with birds actually striking each other and sometimes falling to the ground, grappling. More often, when an intruder nears, guard calls are given, along with conspicuous, stereotyped posturing: an erect stance, with the back feathers raised, and the wings partially opened, beating slowly, all of which probably serves as a warning. Close approach often brings on an aerial chase. Both males and females will defend the nest against intruding Ospreys, and also against predators, but against a conspecific it is generally only the bird of the same sex that participates. Considerable time can be spent repelling intruders, especially in colonies, suggesting that nest scarcity is a key factor for this species. Intruders can thus be quite disruptive, and eggs are sometimes lost or broken in fights.

Against predators, Ospreys are also formidable defenders of their nests, and they will even strike humans with their

talons, in passing dives. At night, the birds are probably more vulnerable; owls and nocturnal climbing mammals make significant inroads at some nesting colonies. Snakes may be a serious threat at nests in subtropical zones. *Haliaeetus* eagles, especially the Bald Eagle (*Haliaeetus leucocephalus*) in North America, occasionally steal prey from flying Ospreys, and they are potential nest predators. When these eagles move in to nest near Ospreys, the latter often move away.

Male Ospreys breeding in New England spend about 195 minutes per day, on average, getting food for themselves and their family, catching some six to eight fish per day. However, in their wintering grounds, they only require about 30 minutes per day to feed themselves, with an intake of one to three fish per day. For breeders, therefore, 65-85% of each day is spent preening, eating, and resting, which are hardly energy-intensive activities. Yet, both male and female breeders are up against real energetic limitations, and lose weight while feeding young. Raising larger broods than normal can be particularly stressful to them, with potentially serious loss of condition.

Ospreys bathe often, both in salt and fresh water, during the breeding season generally in the morning, after being relieved by a mate from nest duties. They also preen and stretch regularly. When soaked after a dive, a bird will twist in mid-air, shaking itself like a wet dog, before settling down, often with its wings drooped, on a perch to dry.

Voice

Three main types of Osprey calls have been distinguished, guard calls, alarm or courtship calls, and begging. Guard calls consist of a slow series of whistled notes falling in pitch, sounding a bit like a whistling tea-kettle being taken off the stove. This call is an Osprey's first line of defence, usually given at a distance, when an intruder, another Osprey, approaches an individual's nest or favoured perch. Occasionally, more intensive, wavering notes are heard, if the intruder comes closer.

Guard calls can shift to alarm notes when an Osprey spots a human, another potential predator, or a threatening Osprey approaching, especially near the nest. Alarms sound like intense guard calls, but are shorter, quicker, more frequent whistles that

also fall in pitch and can grade into excited, high-pitched squeals ("eeee-eeee-eeee"), as the threats approach. These squeals are the same calls given by males during their aerial courtship displays (see Breeding), so they probably have multiple functions, such as attracting mates, claiming territory, and alerting neighbours and mates to danger. Alarms can grade into a harsh, rasping, guttural "ick-ick-ick", when an individual is highly threatened, for example when a human climbs to inspect a nest.

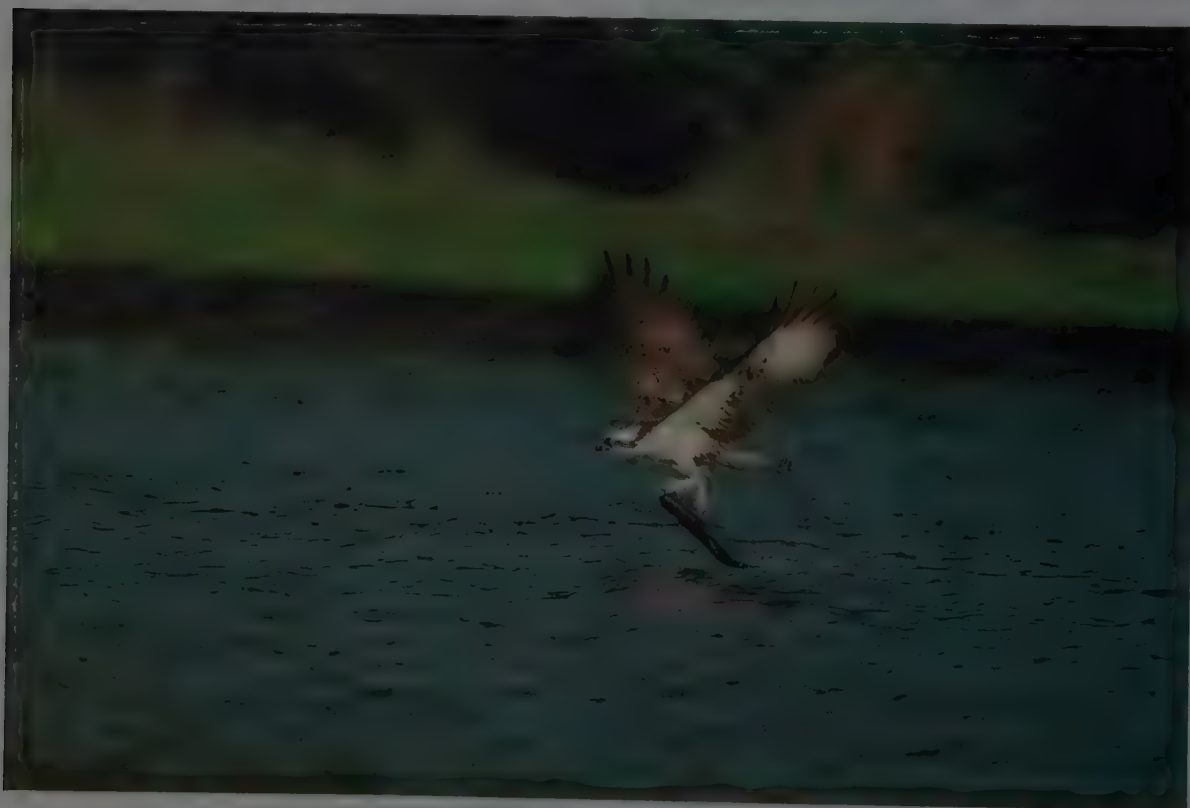
Nesting females, especially hungry ones, direct begging calls to their mates. These calls start during courtship and extend right through the fledging period. Females depend on their mates for food, so begging often seems to be their way of stimulating males to hunt. Males may or may not respond, apparently depending on their own hunger and how recently they last hunted. Female begging calls mimic those of young fledglings, perhaps making it tougher for males to ignore them.

Food and Feeding

Diet and foraging are well studied aspects of Osprey ecology. Unlike any other diurnal bird of prey, Ospreys depend almost exclusively on live fish. Recently dead and dying fish are scavenged on occasions, but such fish kills are rare enough that Ospreys must depend on live prey; very rarely, other small animals are eaten.

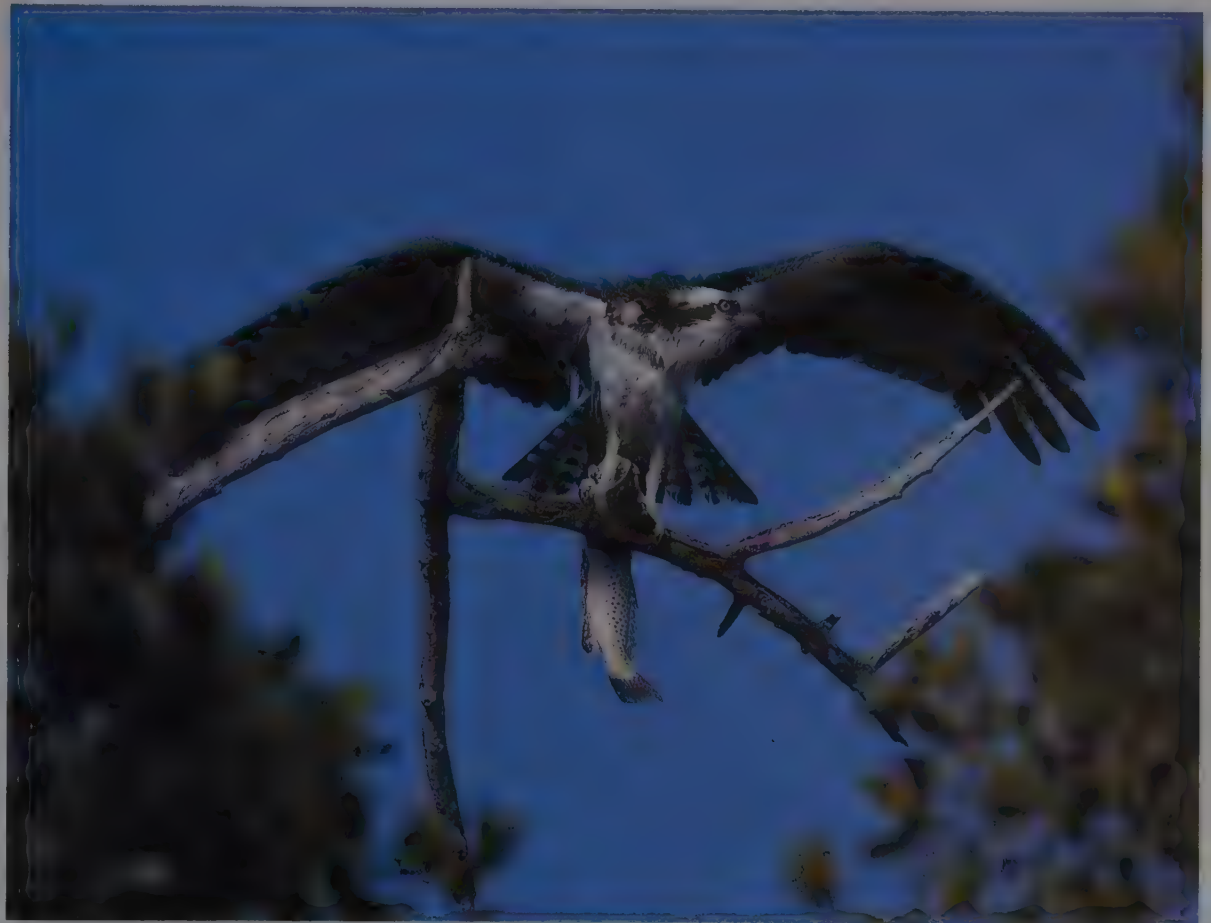
Like most hawks, Ospreys dive feet first and catch prey in their talons. But they are buoyant birds, and, despite their relatively long legs, can penetrate at most only about one metre below the water's surface, probably less. This means that they catch only surface-dwelling fish or those that frequent shallow flats or shorelines, constituting an important limitation and a key fact of Osprey ecology. It explains their preference for living along shallow bays and lakes, and it restricts the species that make up their diet.

Ospreys are generally opportunists, and they will take whatever surface or shallow water fish are most available, usually in the 150-300 g size range although smaller and, rarely, larger fish of 50-1200 g are said to be taken. Nevertheless, they can be selective at times. Along the coasts of Nova Scotia and southern



The Osprey is the diurnal raptor most specialized in catching fish, and these make up its diet almost exclusively. Birds can catch fish of 1 kg or more, but most weigh under 300 g. After a successful plunge, the bird flaps vigorously to gain height, while it grips the fish with two toes forwards and two backwards on each foot. Usually one leg is held behind the other, so that the prey is carried head first, and is thus more streamlined with the body.

[*Pandion haliaetus*.
Photo: Laurie Campbell/
NHPA]



After catching fish, the Osprey usually goes directly to a feeding perch, often a dead branch on a tree. Before eating the fish, the bird waits for it to die, in the meantime drying out its soaked plumage, and usually also preening and oiling. Once the fish is dead, the Osprey begins to eat it, starting at the head.

[*Pandion haliaetus*.

Photo: John Shaw/NHPA]

New England, for example, up to half the fish Ospreys eat during the breeding season are winter flounder (*Pseudopleuronectes americanus*), while herring (*Alosa*), menhaden (*Brevoortia tyrannus*), pollock (*Pollachius virens*) and a few other species make up the rest of the diet. But spawning, migratory fish, such as herring and pollock, often arrive in shoals, and, as they are easily caught and are rich in nutrients, Ospreys tend to concentrate on these fish, when available. In northern Europe, freshwater fish such as pike (*Esox lucius*), bream (*Abramis brama*), carp (*Cyprinus carpio*), and trout (*Salmo*) all provide nourishment, with dietary differences depending on the latitude and the size and depth of the lakes fished. On lakes in northern Florida, Ospreys prefer sunfish (*Lepomis*) in spring and summer, when these fish are most available, and shad (*Dorsoma*) in autumn and winter, when sunfish abundance declines.

Even within regions, habitat has a major influence on the size and species of fish Ospreys catch. At least ten different fish species figure prominently in the diet of European Ospreys wintering in West Africa, along the coast of Senegal, although at any one location the birds take just a few species. Mullet (*Mugil, Liza*) represent a particularly important part of the diet in this zone, as they do for most Ospreys feeding along tropical and subtropical coasts. Mullet swim in tight schools, they frequent shallow water, and are rich in fats, an irresistible combination for a fish-eating bird!

Ospreys generally hunt on the wing, actively searching out prey rather than waiting quietly on perches for fish to swim within striking distance. By flying, birds cover more area, thereby boosting their foraging efficiency, despite using more energy for each minute spent hunting. Fishing Ospreys fly slowly, 5-40 metres above the water, sometimes circling back on themselves and often pulling up briefly to hover before moving on again. When a fish is spotted, the dive can be spectacular: the bird tucks back its wings and falls steeply, often manoeuvring subtly with wings and tail to keep on track toward its target; its feet swing forward just before the strike. If unsure

about a fish, the hawk may drop down in gradual stages for a closer look, before making its final plunge or veering off to another area. Occasionally, a bird swoops down to snatch fish just from the water's surface, barely wetting its plumage in the process. After a plunge, an Osprey usually rests very briefly on the water, probably securing its prey, before reaching high with long, fast, almost horizontal wing strokes, using the flexible, outer portion of its wing. Once airborne, it grips its prey with two toes forwards and two backwards on each foot (see Morphological Aspects), and usually one leg behind the other, so that the prey is carried head first. In the meantime, it often shakes water off its plumage with vigorous twists in mid-air. Holding its prey tightly underneath its body, the successful forager flies low over the water if windy, or circles up higher if travelling far on warm, still days.

Ospreys generally hunt alone but small groups sometimes form where prey is abundant. Tides may influence hunting patterns in some areas, but the time of day seems to be a more important factor. Birds tend to hunt most actively early in the morning and in late afternoon or evening, as might be predicted for a bird that does not forage at night. It is not clear how Ospreys determine where to hunt, but a study at one nesting colony in North Carolina (USA) found that individual males hunting for their mates and small young were remarkably faithful to particular foraging sites, even though there were other sites equidistant from their nests, which were equally productive, and just as faithfully used by other males from the same colony. No study has yet shown convincingly that Osprey colonies act as "information centres", with individuals keying in on where their neighbours go to find food. Although such information exchange has been suggested for Ospreys foraging close to a colony, birds in these situations can often see neighbours hovering, so it is difficult to know what clues they are actually using.

Osprey dive success ranges from about 60-70% on fish like carp, which eat slow-moving benthic organisms, to under 40%

on quicker, predatory species like trout. Weather can have a significant influence, at least severe weather with high winds and heavy rain. Most individuals just stop hunting in such conditions, often with disastrous consequences at nests containing eggs or newly-hatched young. Lesser fluctuations in the weather seem to have little effect on breeding success.

Breeding

Ospreys are generally winter to spring breeders in subtropical latitudes, but spring to summer breeders farther north. Pairs along the Red Sea or in Florida, for example, lay eggs from December to March, while pairs in Sweden, Corsica, and New England lay in April and May. Such differences in seasonality probably reflect differences in fish availability, but this has not been well studied. Clearly spring to summer breeding coincides with the arrival of shoals of fish that move into warming rivers and coastal shallows to spawn or feed. The birds arrive and lay as early as spring temperatures and the retreat of the ice allow.

Ospreys are generally monogamous. However, where nests are close together and a male can easily defend more than one site, polygyny can occur, with one male mated to two females; single females are often attracted to empty nest-sites. Very rarely, two females may share a single nest, where sites are limited. Success of secondary nests is poor compared to primary nests, largely because secondary females are neglected by their mates.

Courtship revolves around food and nest-sites. Individuals with established nests tend to return, separately, to those used the year before, especially if the pair has successfully raised young there. Singletons, which may be new arrivals, generally young birds, or alternatively widowed birds, either find an empty nest-site and guard it, or settle in with another single, established bird of the opposite sex. Such birds may also move nomadically through a colony or region looking for an available site, but little is known about this. Where unoccupied sites are plentiful, individuals first breed at three to four years of age, but where scarce, they may delay until they are five or six. Once settled at a site, a female often begs from her mate and sometimes, if hungry, from other nearby males. The males brings fish to the female, generally feeding first himself near the nest, and then delivering the remainder to his mate. A female will copulate often with a mate that feeds her, but rarely with one that does not.

Once a pair of Ospreys settles at a nest-site and starts courtship feeding, mating can occur at almost any time or place, but it is most frequent early in the morning, around the same time as egg-laying. The male mounts female gently, his talons closed and his tarsi resting somewhat precariously along the female's back. Vigorous flapping helps the male to balance. If the female is receptive, she tips herself forward to allow the male's tail to scissor under her own. Young pairs are less likely to copulate successfully than older ones, largely because young males are often reluctant to transfer food to their mates, leaving the female unreceptive for breeding. Pairs average nearly 60 successful copulations per clutch, starting at least two weeks, and peaking a few days, before egg-laying. Because females will sometimes copulate with males other than their mates, males protect their paternity by frequent copulation and by maximizing their time with the female when she is most fertile.

Both the male and the female participate in the building of the nest, and they add material throughout the breeding season. They start with large sticks and then add a lining of softer, flatter material, such as seaweed, dead grass, or leaves. Sticks are forcibly broken off trees or are picked up off the ground. Like the best of pack rats, these birds collect an astonishing array of flotsam and jetsam, including cardboard, bones, hunks of sod, rope, plastic bags and fishing line; these last two items occasionally smother or entangle the young. Nests can become huge, even big enough to support a large man, and in some cases they are reused for generations. Clearly they are much larger than is needed for just a few small eggs, so year to year stability may be one goal, territorial advertisement another.



Copulation is most frequent before egg-laying, when it can occur up to seven times daily, but it continues throughout the laying period and even during incubation. It usually takes place on the nest, although it sometimes occurs on a regularly used perch nearby. The male alights on the female's back, keeping his balance by wing-flapping, and remains there for 7-10 seconds.

[*Pandion haliaetus*.
Photo: Leonard Lee Rue/
Bruce Coleman]

The female lays two to four eggs, generally three, though on average, smaller clutches are laid at lower latitudes. With their pale tan or fawn-coloured background, and their chestnut swirls and splotches, these have long been prized by egg-collectors. On average, eggs measure 62 x 46 mm and weigh about 60-80 g, so a clutch of three represents about 10% of the female's body weight, which is not a significant energetic demand. Indeed, feeding rates during courtship seem to have little influence on clutch or egg size, although lack of food may delay breeding. Late-breeding pairs tend to have smaller clutches and produce fewer young than early pairs.

Eggs are laid one to two days apart. Both sexes incubate, with the female usually doing more, although there is great variation among pairs in the division of this labour. Incubation is often sporadic with the first egg, but is more regular with the second and third. Hatching occurs after about 40 days. Because the first and second eggs are usually larger than the third and fourth, and because they hatch earlier, the first and second chicks to hatch generally have a significant advantage over their younger siblings. This is especially critical in years and regions of food scarcity, when chicks fight for access to the female, when she is distributing food. Larger, older chicks invariably win over their younger nestmates.

To anyone watching a nest, it is obvious when the chicks hatch. After the male delivers food, the female stays at the nest to feed, sharing the fish with her young by breaking off small bits to feed them, instead of flying away from the nest to eat at a nearby perch, as she usually does when incubating eggs. At hatching, chicks are weak, wet, and relatively helpless. Their eyes are open and their bodies are covered with a frizzy coat of white down. Although they can beg food from a parent, they still need to be brooded regularly during both hot and cold weather. By ten to fourteen days of age, the second coat of down, charcoal-like in colour, has replaced the first, and chicks have an easier time controlling their own body temperature, but, even so, they are generally brooded by the female at night and during the heat of day. Chicks are quite mobile by this age, and they quickly approach the female when food is delivered. They also back up, to eject their faeces over the rim of the nest.

Depending on the size of the fish caught, a male parent will deliver three to ten fish per day, rarely more, during the nestling period, and about 30-40% less during incubation. This translates to about 60 g each daylight hour early in the nestling stage, with about 100 g per hour during the period of peak demand, when the chicks are bigger. A fish is usually shared sequentially, but not equally, first by the male and then by the female and her young. Once they are large and are growing actively, the chicks get most of the food, especially in large broods of three or four. The female gets the least because she

Ospreys usually build their nests on trees, rock pinnacles or cliffs. Less often, they use telegraph or power poles and other man-made structures, tall cacti, or small bushes; they will even nest on the ground, especially on islands that are free from predators. The nest is constructed of large sticks, twigs, seaweed, driftwood and miscellaneous items. New material is added throughout the breeding season and, as the nest may be used year after year, it becomes a huge structure, especially considering the size of the bird; some old nests can grow to be as much as two metres deep.

Several studies of populations nesting in trees have shown that the birds apparently select the nesting tree more on the basis of the shape of the tree than on the species. They prefer dead, rather than living, trees, those with broken off crowns, and emergent trees that are taller than surrounding vegetation.

[*Pandion haliaetus*.

Photo: Fritz Polking/FLPA]





The mottled pattern of Osprey nestlings helps them to blend into the nest, and it is actually very difficult to spot them in their nests from above, especially when they are lying flat, as they do in presence of intruders. This, together with the almost constant attendance of female Ospreys at their nests, suggests that there is a significant threat of predation by other birds, probably by *Haliaeetus* fish-eagles. The eggs, well marked with brown blotches and spots, are also cryptic, and this presumably helps to avoid nest predation by crows and ravens (*Corvus*). The large size of the Osprey's nest, and also the fact that it is usually in a conspicuous site, make it an obvious target for other avian predators.

[*Pandion haliaetus*.
Photo: Vireo]

must feed begging young. As a result, female parents tend to lose weight during the breeding season, while males rarely do.

Young Ospreys can fly at about 50 days old, or a little later if food is not plentiful. At least in migratory populations, young fledged early in the season survive much better than those fledged late on, probably because they have extra time to gain flight and foraging skills, before leaving on their long migrations. Parents continue to bring food to their young for two to eight weeks after fledging, easing the difficult transition to independence. Once migration begins, however, each bird travels on its own. This is a potentially hazardous journey, especially for young birds. At least 70% of the young that fledge die before they reach breeding age, generally in the first six months after fledging.

As might be expected, there is great variation in breeding success between different regions and even within colonies. Young birds, especially first time breeders, produce fewer offspring than experienced birds. Periods of bad weather, especially heavy rain or high winds, can drastically lower nesting success, because most males either stop hunting altogether or catch very few fish. In addition, Osprey eggs and chicks are vulnerable to predators, especially climbing mammals, and perhaps snakes in subtropical regions; these can take a significant toll at nests that are not isolated by height or water. In migratory populations, to balance the annual mortality of adults, on average roughly one bird must fledge for each nest with eggs. Pairs at coastal colonies tend to reach this level easily in most years, but those nesting inland, at freshwater sites, have more difficulty in attaining this average, which, in part, reflects differences in food availability.

One long-term study that followed a generation of Ospreys in Michigan, USA, showed that: the individuals that lived the

longest produced the most fledglings; many breeders raised no young at all; the number of young birds raised to fledging was correlated with the numbers subsequently recruited to the breeding population; only about 14% of the eggs laid, and 27% of the young fledged, contributed fledgling Ospreys to the next generation; and death before reaching breeding age prevented most individuals (70.5%) from contributing fledglings to the next generation, whereas failure to raise any young, once breeding had been attempted, affected a much smaller proportion of individuals (3.6%).

Movements

Migration is one of the best studied aspects of Osprey ecology. Because these birds have been extensively ringed in several populations, with significant numbers of recoveries afterwards, and because they often concentrate at "hawkwatch" locations, where other migrant birds of prey are studied and counted, their passage south to wintering grounds, and north again to breeding grounds has been followed in considerable detail, at any rate for those populations nesting in Scandinavia and the northern USA.

Not all Ospreys are migrants, only those nesting in regions where winter freezes are regular, as these conditions drive fish into deeper water or make them otherwise inaccessible. In North America, for example, migrants breed north of about 30°-32° N, with the division between the migrant and non-migrant, or resident, populations situated around northern Florida, southern Alabama and Mississippi. In Europe, the cut-off is farther north, at about 38°-40° N. Thus, all middle and northern European populations migrate, as do most of the pairs breeding along Mediterranean shores.

During the fledging period the male does all the hunting for the family. He usually brings three to ten fish per day to the nest, departing each time shortly after delivery. The female remains on the nest for the first 28-30 days after the chicks have hatched. When the fish is brought, she tears it up and feeds the young with a rapid succession of tiny morsels, up to ten per minute, passing the food bill to bill. She continues to feed the young regularly for up to 42 days, and thereafter sporadically, even after the young have left the nest.

[*Pandion haliaetus*.

Photo: Joseph van Wormer/Bruce Coleman]



Although their movements have been little studied, "residents" may wander locally during the non-breeding season, but they tend to remain within a few hours' flight of their nest. One exception may be among Southern Hemisphere breeders, the coastal nesters in Australia, where individuals tend to move farther inland after breeding.

Broadly speaking, migrant Ospreys in the Northern Hemisphere tend to winter south of latitudes where residents are found. Ospreys hatched in the northern USA, for example, nearly always migrate south of Belize or Cuba, where the southernmost populations of New World residents nest. These migrants fly at least to the southern Caribbean, and most go on to the northern coasts of South America, and inland through the vast drainage basins of the Amazon and the Orinoco, or up the Cauca and Magdalena Rivers in Colombia. This separation of resident breeders and wintering migrants suggests that competition between the two groups could be a factor in migration patterns, or simply that food is more plentiful farther south. Many Ospreys from the USA have been recovered south of the equator, although few venture south of 20° S. Ospreys from Scotland, Sweden, and Finland winter at similar latitudes in Africa, especially in West Africa, in an arc stretching along the coast from Senegal south-east to Cameroon. There, the birds are supported by a highly productive network of interlacing ecosystems: rain forest, coastal mangrove, and broad, seasonally flooded rivers.

For North American and Palearctic Ospreys, southward migration starts in late summer or early autumn, and most nests are empty of birds by the first week of September. Each individual bird carries out its migration alone. Some individuals may reach wintering grounds in a month or less, although many, especially young birds, appear to take longer. By mid-November most have arrived in their winter quarters, where they stay for at least three months, rarely moving far and often returning to the same location in subsequent years. By the middle or end of February, northward migration is well under way, with individuals apparently travelling faster than they do in autumn; spring breeding is an urgent business, especially as early breeders fledge the most surviving young (see Breeding).

The Osprey is not primarily a soaring migrant, dependent on thermals and updraughts, like many *Buteo* species (see

page 87). Thus individuals regularly cross water barriers such as the Caribbean and Mediterranean Seas, and likewise the Sahara Desert, a trip of at least 2000 km, taking 40-60 hours. Along the Atlantic coast of the USA, Ospreys are regularly seen at sea, up to 100 km offshore. Most of them, however, migrate along the coast, or inland along mountain ridges.

Ospreys tend to return, as breeders, to their natal areas, especially where nest-sites are plentiful. Where sites are limited, pairs may disperse farther. As with many other birds, females disperse farther than males, probably because this enhances their possibilities in the search for a mate and a nest. Once it has found a nest-site, an individual rarely moves far, although few data are available from colonies with unstable nest-sites, where blowdowns are regular.

Relationship with Man

Few other birds have invoked man's admiration and concern more than Ospreys. Wolof tribesmen in Senegal sing of the Osprey's fishing prowess as they paddle canoes through Atlantic surf to tend their nets. South American tribesmen are known to insert Osprey bones into their forearms to increase their hunting skills.

Modern man, especially in the West, has learned to appreciate Ospreys in different ways and for slightly different reasons, but especially for their drama and rarity. As more and more Ospreys have begun to nest on artificial platforms (see Status and Conservation), certain individuals and organizations have become nearly obsessed with building such nesting sites for them. In Florida, New England, and parts of Scandinavia, for example, people compete for "backyard Ospreys". Entire local populations of Ospreys have been converted to depend on such structures, which provide safe nesting sites in an environment where human commensals, like raccoons (*Procyon lotor*), reach epidemic numbers, and raid all the nests they can reach. In addition, Ospreys nest successfully on duck hunting blinds and on power poles, occasionally shorting out electricity at the latter, when nests become wet. Electric power companies have gone to great lengths and expense to avoid such complications, in some cases actually moving nests to

nearby poles erected specially for the Ospreys. Ospreys are proving so adaptable that they sometimes nest alongside towns and in suburbs; such nests become local landmarks, like those of the storks of Europe. In Sanibel, Florida, one can see what is perhaps the Osprey nest of the future, built on a television antenna!

Ospreys generally fare poorly in captivity, and this is especially true of males, which are more nervous and highly-strung than females. The species is rarely kept as a pet or in zoos, and has never been bred in captivity. Likewise, it is apparently untrainable for use in hawking or falconry, even for its normal business of fishing.

In a few parts of the Osprey's range, its eggs have been prized both for their beauty and for their rarity; indeed, in Great Britain, egg-collectors played an important part in driving the species to extinction in the early twentieth century (see Status and Conservation). In addition, precipitous population declines in the north-eastern and midwestern USA, during the period 1950-1970, were a key factor in the government's decision to ban the use of the pesticide DDT (see Status and Conservation).

Status and Conservation

As with other birds of prey, some people have considered Ospreys a threat and a nuisance, and thus worth shooting or trapping. Although it is difficult to tell for sure, apparently more Ospreys have been shot or trapped in Europe than elsewhere, primarily by fishermen and those who operate fish farms and hatcheries, but also by those so-called "sportsmen" who mindlessly shoot raptors in migration. On the Mediterranean island of Malta, for example, where Ospreys concentrate along with many other birds during autumn migration, a notorious hunt has occurred during September and October each year for decades, with thousands of raptors killed each year, at least 10-20% of which may be Ospreys. This massacre continues today.

In Britain and parts of central Europe, by contrast, Ospreys were shot and pole-trapped regularly near fish ponds and trout hatcheries during the nineteenth and much of the twentieth centuries, but this slaughter has been curbed considerably since the 1960's and 1970's. Both migrants and breeders were killed, but loss of breeders was especially critical and helped drive local populations to extinction. In North America, such killing seems to have been less severe, although certain fish hatcheries have undoubtedly taken a toll locally. Elsewhere, the data are too few to reveal much about shooting. It is noticeable, however, that along the Mediterranean and Red Seas, and the Persian Gulf, Osprey colonies survive only on remote islands or where they are protected.

Although Osprey populations in the USA escaped severe shooting, pesticides, particularly the chlorinated hydrocarbon DDT, hit them hard. Between 1950 and 1970, for example, nearly 90% of the roughly 1000 pairs of Ospreys nesting along the coastline between New York City and Boston disappeared, leaving behind empty nests. Some birds were killed outright; most simply failed to reproduce, their eggs dead due to insecticides concentrated in the fish that laying females had eaten. As with other birds of prey, eggshell thinning aggravated these losses. Other US populations were almost as severely affected by pesticides during those years, for instance those of New Jersey, Maryland and Michigan, although most of the rest of North America's Ospreys escaped relatively unscathed, as did most Ospreys of the Western Palearctic. To be sure, Swedish Ospreys showed some contamination, enough to thin eggshells and reduce hatching rates significantly in a few locations, but not enough to affect population levels overall. Mercury may have been a more critical contaminant in Sweden, killing eggs and perhaps adults, but here again the effects were apparently localized. Overall, Swedish and other Fenno-Scandian Ospreys survived the pesticide era with their breeding numbers relatively intact. By the late 1970's, environmental regulations had banned the use of DDT and its most toxic relatives in nearly

all the countries where Ospreys bred, and had slowed the release of mercury from factories and mining. Although these compounds continue to be sold and used flagrantly in some countries where Ospreys winter, almost no effect on these birds has been demonstrated so far.

As certain Osprey populations dwindled during the pesticide era, one human response was to increase the nesting structures available to the pairs that remained. Such artificial nesting platforms are generally easy to build and provide great stability and durability, boosting local numbers of breeders where reproductive success is adequate. The idea has caught on like wildfire, and variants of these platforms continue to be built throughout the Osprey's North American and Palearctic ranges: in Sweden, trees are topped and platforms wired in; in New England, short poles with platforms nailed atop are dug into salt-marsh islands, and now over 80% of the population nests on artificial structures; and in many countries, hydro-electric poles are modified so that Ospreys can nest atop them safely. Highly adaptable, the Osprey also nests on a host of other artificial sites that are not designed for it, including buoys, windmills, sunken ships, and hides or blinds in marshes used by hunters (see Relationship with Man).

Another way to conserve Osprey populations is to reintroduce birds to regions where they once bred or were more numerous. By bringing young to artificial nests in desired locations, and letting them fledge there, a process known as "hacking", researchers have shown how well these birds will return to their new locations, rather than to the areas where they hatched. Highly successful Osprey reintroduction programmes have been carried out recently in many parts of the USA, most notably Pennsylvania, Minnesota, and New York State. Another is planned for southern Germany. Few birds respond better to reintroductions than Ospreys, provided the new area has suitable habitat.

In central and eastern Europe, Osprey numbers declined drastically from the eighteenth century, particularly after the introduction of firearms, right up to the 1970's, the victims of shooting and egg-collecting. Several of these populations appear to have stabilized in recent decades, with strongholds in north-eastern Germany, in the lake districts of Mecklenburg and Brandenburg, and in Poland; there are also a few new nests in southern France. Still vulnerable are the few small colonies along Mediterranean shores and islands, on Corsica and the Balearic Islands; also those on the Cape Verde and Canary Islands; and others in the Middle East. But these populations have probably always been marginal, at least since human settlement; reintroduction possibly holds the potential for boosting their numbers to stronger levels.

In Scotland, Ospreys were eliminated by gamekeepers and egg-collectors by the early years of the twentieth century. However, they recolonized, probably from Scandinavia, during the 1950's, and since then the growth of this population has been steady. Few conservation success stories have been greeted with more enthusiasm. In 1959, the celebrated nest at Loch Garten, in the central Highlands, was first made known to the general public, and in only seven weeks, some 14,000 visitors came to watch the birds at their nest from a nearby hide. Over 1,000,000 people have now visited the site. The fact that the Osprey has managed to re-establish itself as a breeding bird in Scotland is in large part due to the constant vigilance of nests by a whole host of volunteers, for Ospreys still have their enemies: of 54 nests occupied in 1989, nine were robbed by egg-collectors.

In the north-eastern USA and around the Great Lakes, populations have likewise rebounded dramatically since the ban on pesticides in the 1960's and 1970's. In southern New England, for example, numbers are back to 50-60% of the pre-DDT levels, with population growth rates of 10-20% per year. Recent data suggest that such phenomenal growth may be slowing, in part due to density dependent factors, such as predation, but there is no doubt that these once threatened populations will be there for the long haul, especially given their adaptability in nesting along developed coastlines and adjusting to human disturbance.



PLATE 2

Family PANDIONIDAE (OSPREY) SPECIES ACCOUNTS

PLATE 2

Genus *PANDION* Savigny, 1809

Osprey

Pandion haliaetus

French: Balbuzard pêcheur

German: Fischadler

Spanish: Aguila Pescadora

Other common names: Fish Hawk

Taxonomy. *Falco Haliaetus* Linnaeus, 1758, Europe = Sweden.

Sometimes included within family Accipitridae, but usually in its own subfamily, Pandioninae. Race *melvillensis* often applied to birds from Indonesia to N Australia, but probably not valid; similar to *cristatus*. Four subspecies currently recognized.

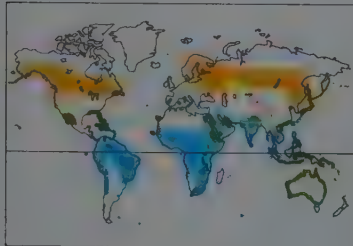
Subspecies and Distribution.

P. h. haliaetus (Linnaeus, 1758) - Scandinavia E to Japan and S to Mediterranean, Red Sea and Cape Verde Is; winters S to S Africa, India, W Indonesia and Philippines.

P. h. carolinensis (Gmelin, 1788) - Labrador W to Alaska and S to Florida and Arizona; winters S to Peru and S Brazil.

P. h. ridgwayi Maynard, 1887 - Caribbean, including Bahamas, Cuba and Belize.

P. h. cristatus (Vieillot, 1816) - Australia E to New Caledonia, and N through New Guinea to Java and Sulawesi.



Descriptive notes. 55-58 cm; male 1200-1600 g, female 1600-2000 g; wingspan 145-170 cm. Females slightly larger. Dark stripe through eye; speckled brown necklace, variable in intensity depending on race and sex, generally less marked in males. Distinctive pattern in flight, all white below with blackish brown carpal patches and greater underwing-coverts; wing bends back at carpal joint giving characteristic shallow V-shape. Wings relatively long and narrow. Immature similar to adult but paler brown above, with feathers edged buff; breast band less marked. Races similar, differing mainly in size and plumage: *carolinensis* slightly larger and darker; *ridgwayi* paler above, on head and on breast, than *carolinensis*; *cristatus* smaller, with dark breast band and relatively pale crown.

Habitat. Shallow waters, fresh, brackish and marine. Nests along lakeshores, seashores, marshes and rivers; also on deadwood swamps and reservoirs. Highest densities generally near salt water, especially salt-marshes, mangrove swamps, coastal lagoons and bays. Favours islands for nesting, thereby gaining protection from predators. Becomes accustomed to human activity, so tolerates suburban, even urban habitats. Feeds in rivers, bays, marshes, reservoirs, lakes and ponds, wherever fish are available near water surface.

Food and Feeding. Almost exclusively live fish, mostly of 150-300 g. Takes wide variety of fish species, with some marked local preferences (see page 45). Dramatic dives from heights of 10-40 m, but seldom goes much below surface of water. Secures fish in talons before flying off. Normally feeds alone but can gather in small flocks where fish plentiful.

Breeding. Season varies with region: generally spring and summer in temperate latitudes; winter to spring in tropical and subtropical latitudes. Most pairs monogamous but polygynous trios form where males can easily defend two nest-sites. Nest is large collection of sticks and flotsam, usually wedged high in an exposed tree; also nests on cliffs, power poles, buoys, specially designed platforms, and also on ground, on predator-free islands. Normally 3 eggs (1-4); incubation 35-43 days; chicks tend to hatch sequentially, 1-7 days apart, and youngest chicks disadvantaged when food scarce; chicks hatch with white down, but moult into charcoal-coloured second down after 10-14 days; fledging averages c. 50 days. Sexual maturity at 3 years old; 60-70% die before reaching breeding age; potential longevity 20-25 years.

Movements. Resident in tropical and subtropical latitudes. Migratory elsewhere, generally moving to latitudes near the equator: Amazon Basin and N coast of South America; and coastal W Africa from Senegal to the equator.

Status and Conservation. Not globally threatened. CITES II. Frequent to abundant throughout much of range, e.g. 900-1000 pairs in Finland and at least 2000 pairs in Sweden during late 1980's. Estimated c. 10,000 pairs in Russia, although species redlisted here, categorized rare; figures for 1990's include 3000 pairs in European Russia, and 120-180 pairs in Byelorussia where has apparently increased over last 20 years; extremely rare breeder in Ukraine, with only 2-7 pairs in 1990's; in Azerbaijan, extinct as breeder since 1952, as result of deforestation and also collection of eggs and specimens, although formerly very common in SE. Recovering strongly in NE USA, where numbers reduced by pesticides, especially during period 1950-1970. Also recovering in Scotland, where extirpated in early 20th century, due to hunting and egg-collecting; recolonized in 1950's, and upwards of 80 pairs now breed. Vulnerable populations still found in: parts of Mediterranean, in Corsica (20 pairs), Algeria (6-10 pairs), Morocco (20-25 pairs), and Balearic Is (10-15 pairs); Cape Verde Is (c. 25 pairs) and Canary Is (10-15 pairs); Portugal (2 pairs); Red Sea and Persian Gulf; and Caribbean. Also vulnerable in C and E Europe, where populations apparently stabilizing, perhaps with slow growth, e.g. recent colonization of S France by several pairs. Many birds still shot on migration over Mediterranean, e.g. on Malta. In Australia generally common and secure on coasts, especially in tropics and subtropics. Scarce in S parts of Australia; does not breed in Victoria; now absent from Tasmania; vulnerable in New South Wales, now only breeding on N coast, with population fairly stable at c. 50 pairs. Australian birds generally free from contamination and persecution, although some local disturbance near urban areas. Status of breeders in nearby SW Pacific unknown. Reintroduction techniques can help restore vulnerable populations. Pesticides now reduced to a minor threat.

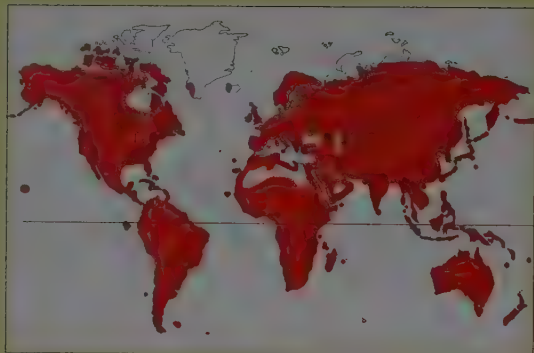
Bibliography. Ahlgren & Eriksson (1984), Ali & Ripley (1978), Ames (1966), Bent (1937), Bird (1983), Birkhead & Lessells (1988), Blake (1977), Boshoff & Palmer (1983), Bouvet & Thibault (1980), Brazil (1991), Bretagnolle & Thibault (1993), Brown, L.H. (1976c, 1984), Brown, L.H. & Amadon (1968), Brown, L.H. *et al.* (1982), Brown, P.E. (1979), Brown, P.E. & Waterson (1962), Coates (1985), Cramp & Simmons (1980), Delgado *et al.* (1990), Dennis (1983), Dickinson *et al.* (1991), Edwards (1988), Ehrlich *et al.* (1992), Eriksson (1986), Eichcoper & Hue (1978), Fjeldså & Krabbe (1990), Friedmann (1950), Gierow (1992), Ginn *et al.* (1989), Glutz von Blotzheim *et al.* (1971), González *et al.* (1992), Green (1976), Greene (1987), Grimmett & Jones (1989), Hagan & Walters (1990), Handrinos & Demetropoulos (1983), Henny (1983), Henny & Wight (1969), Hollands (1984), Jamieson & Seymour (1983), Johnsgard (1990), Johnson (1965, 1972), Kirkconnell & Garrido (1991), Knystautas (1993), Kushlan & Bass (1983a), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Marchant & Higgins (1993), van Marle & Voous (1988), Martin (1992), Medway & Wells (1976), Meyburg & Meyburg (1987), Monroe (1968), Newton (1979, 1989), Odsjö & Sondell (1976), Ogden (1975), Österlöv (1977), Palmer (1988), Paz (1987), de la Peña (1992), Pickford *et al.* (1989), Pinto, A.A.R. (1983), Pinto, O.M.O. (1964), Poole (1985, 1989), Poole & Agler (1987), Postupalsky (1989), Prevost (1982, 1983), Reese (1969, 1977), Richardson (1990), Roberts (1991), Rogacheva (1992), Rymon (1989), Schaadt (1991), Schaadt & Bird (1993), Sick (1985a, 1993), Simonov *et al.* (1990), Slud (1964), Smythies (1981, 1986), Snyder & Snyder (1991), Snyder & Wiley (1976), Spitzer (1989), Spitzer *et al.* (1978), Steidl & Griffin (1991), Swenson (1979), Terrasse & Terrasse (1977), Thibault & Patrimoine (1991), Tishechkin & Ivanovsky (1992), Tostain *et al.* (1992), Ueoka & Koplin (1973), Westall (1984), Wetmore (1965), Wiemeyer, Bunck & Krynsky (1988), Wiemeyer, Schmeling & Anderson (1987), Yekutieli (1991), Zari (1979).

Class AVES

Order FALCONIFORMES

Suborder ACCIPITRES

Family ACCIPITRIDAE (HAWKS AND EAGLES)



- Small to large diurnal birds of prey, with hooked bill and fleshy cere, powerful legs and feet, sharp, curved claws, and often broad wings; keen vision.
- 20-150 cm.



- All regions except Antarctic; almost all zones support numerous species, but only one occurs in N Arctic.
- All habitats, from forests to wetlands, sub-deserts, tundra, high mountains and urban areas.
- 237 species, 64 genera, 535 taxa.
- 29 species threatened; none extinct since 1600.

Systematics

The first fossil records of raptors date back to the early Tertiary, 30-50 million years ago, notably from deposits in France from the late Eocene and early Oligocene, 35 million years ago, and from the early Oligocene of South America. These birds were buzzard-like in appearance, but they had apparently no phylogenetic connections with today's buzzards, in spite of the probable Gondwanan origin of both. During the Miocene, they were already numerous and widespread in both the Old and the New Worlds.

The relationships of Falconiformes with other birds are still not clear, and even among the Falconiformes, there is no evidence in fossil records that the different families have a common ancestor. It is still possible that the members of this order may be the result of an evolutionary convergence between groups of polyphyletic origin. They have no close relatives among living or fossil species.

According to the most recent classification based on DNA-DNA hybridization, the traditional Falconiformes, or diurnal raptors, would be better placed in the infraorder Falconides within the larger order Ciconiiformes. This infraorder would not include the New World vultures (Cathartidae), which have much closer affinities with the Ciconiiformes (see page 24).

The former geographical distribution and division of the Falconiformes is somewhat confusing. For instance, fossils of Old World vultures (Accipitridae) are known from the early Miocene to the late Pleistocene, alongside New World vultures (Cathartidae), in both Old and New World deposits, but the former group has since disappeared totally from the American continent, whereas the cathartid vultures are now restricted to it.

The Accipitridae are, and have always been, the most numerous family of Falconiformes, and they are also one of the largest avian families. As the Osprey (*Pandion haliaetus*) is nowadays normally placed in a separate family (Pandionidae), there are no subfamilies recognized within the Accipitridae.

The details of any taxonomic list vary a great deal according to the opinions of the authors, and successive major classifications are very rarely identical. Many taxa are converted from species to subspecies or vice versa, while at the same time some species are switched from one genus to another. Thus, the number of species recognized in recent times has ranged from about 212 to 240.

Compared with the classification adopted herein, up to seven genera have been deleted, or up to three more added, in recent lists, and this, without considering several older, outdated names. More than half of the genera, 36 out of 64, are monotypic. The two largest genera, *Accipiter* and *Buteo*, contain 50 and 28 species respectively. Of the total of 237 species, 59% have no subspecies at all, but at the other extreme the Crested Serpent-eagle (*Spilornis cheela*) has 21 subspecies, the Variable Goshawk (*Accipiter novaehollandiae*) has 23, and



The affinities of the Pearl Kite are not altogether clear. It has frequently been considered to belong in the Falconidae, its small size and plumage pattern recalling those found in some falconets. However, its feather lice, as well as a number of anatomical features, indicate that it is a kite, and it appears to be closest to the widespread genus *Elanus*.

[*Gampsonyx swainsonii swainsonii*, Ceará, Brazil.
Photo: Luiz Claudio Marigo/Bruce Coleman]

The Bat Hawk is another enigmatic raptor that shows a certain resemblance to falcons, especially in its flight silhouette. This species appears to be an aberrant kite, with its nearest relatives variously reckoned to be in the genera *Aviceda*, *Pernis* or *Elanus*. However, it is unique in several features, most notably in its large eyes and very wide gape. Both of these attributes are adaptations to its habit of feeding on bats around dusk and dawn, when the bird must make optimum use of the short hunting period available, swallowing bats whole as they move to or from their diurnal roosts.

[*Macheiramphus alcinus anderssoni*, northern Transvaal, South Africa.
Photo: Peter Johnson/NHPA]



seven other species have 10-16 such geographical forms. Some little known island subspecies may still prove to be distinct species, for instance several forms in the Crested Serpent-eagle or the Variable Goshawk complexes, or the form *renschii* of Bonelli's Eagle (*Hieraaetus fasciatus*), which occurs in the Lesser Sunda Islands.

Among the most controversial issues within the Accipitridae, one can mention the splitting of several pairs or groups of species that have frequently been regarded as single species. These include: the marsh-harrier complex in the genus *Circus*, containing the forms *aeruginosus*, *ranivorus*, *spilonotus*, *approximans* and *maillardi*; the Short-toed Snake-eagle complex in the genus *Circaetus*, involving the forms *gallicus*, *beaudouini* and *pectoralis*; the Sharp-shinned Hawk group in *Accipiter*, comprising *striatus*, *chionogaster*, *ventralis* and *erythronemius*; and the Augur Buzzard group in *Buteo*, containing *augur*, *archeri* and *rufofuscus*. However, all of these forms are easily identifiable, even in the field, and have non-overlapping breeding distributions, which, together with other differences, justify their specific status.

Similarly, there are several species pairs which were long regarded as conspecific forms, and which look much alike, but are, in fact, allopatric or parapatric, with breeding ranges which are segregated or contiguous but do not overlap. These forms probably deserve separate specific status too. Among such cases are: the Western Honey-buzzard (*Pernis apivorus*) and the Crested Honey-buzzard (*Pernis ptilorhynchus*); the African Harrier-hawk (*Polyboroides typus*) and the Madagascar Harrier-hawk (*Polyboroides radiatus*); the Eastern Chanting-goshawk (*Melierax poliopterus*) and the Pale Chanting-goshawk (*Melierax canorus*); the Red-chested Goshawk (*Accipiter toussenelii*) and the African Goshawk (*Accipiter tachiro*); the Spanish Imperial Eagle (*Aquila adalberti*) and the Eastern Imperial Eagle (*Aquila heliaca*); and, finally, Bonelli's Eagle and the African Hawk-eagle (*Hieraaetus spilogaster*). Sometimes the two species are sympatric, but are segregated by habitat, as is the case of the Common Black Hawk (*Buteo-*

gallus anthracinus) and the Mangrove Black Hawk (*Buteogallus subtilis*), or by altitude, as in the Crested Serpent-eagle and the Kinabalu Serpent-eagle (*Spilornis kinabaluensis*). Amongst the forms hovering around the borderline of full specific recognition are the races *lineatus* and *aegyptius* of the Black Kite (*Milvus migrans*), and also the race *plagiatus* of the Grey Hawk (*Buteo nitidus*).

Some species have not always been placed in a genus of their own as they actually deserve, for instance the Hooded Vulture (*Necrosyrtes monachus*) which has been included in *Neophron*, the Red-headed Vulture (*Sarcogyps calvus*) which has been placed in *Aegypius* or *Torgos*, or the Gabar Goshawk (*Micronisus gabar*) which is often incorporated in *Melierax*. On the contrary, others are more rightly placed in another existing genus, for example the Chestnut-shouldered Goshawk (*Erythrotriorchis buergeri*) of New Guinea, which has close morphological affinities with the Red Goshawk (*Erythrotriorchis radiatus*) of Australia. The genus *Rostrhamus*, with two species united conveniently on the basis of a striking food specialization, may also be divided. Indeed, the Slender-billed Kite (*Rostrhamus hamatus*) is so different from the Snail Kite (*Rostrhamus sociabilis*) in terms of shape, style of flight, display, calls and habitat that it might well be more aptly returned to its own monotypic genus, *Helicolestes*.

This highly diverse family can be usefully divided into natural groups that bring together species with high morphological or ecological convergence. Such an arrangement may not reflect the actual evolution within the family in a systematic sense, but it does illustrate the multiple radiation that has occurred, from the apparently most primitive forms to the supposedly derived and more evolved species.

The first group is the kites, a heterogeneous assemblage of 33 species, which may be divided into three subgroups. The scavenging or insectivorous habits of most of these species are thought to be primitive traits, from which more predatory species may have evolved. Members of the first subgroup lack the bony shield which projects above the eyes and gives the



other accipitrids their fierce appearance. They feed extensively on caterpillars (*Aviceda*), wasp nests (*Pernis*, *Henicopernis*, *Leptodon*), aerial insects (*Elanoides*), arboreal snails (*Chondrohierax*) or bats (*Macheiramphus*). The second subgroup of kites (*Gampsonyx*, *Chelictinia*, *Elanus*) feed on small insects or rodents, or both, and have the talons flat or rounded, not grooved, as in other accipitrids. The third subgroup contains ecologically diverse species, all of which have the basal joint of the middle toe fused with the next joint beyond it. They include the New World genera *Rostrhamus*, *Harpagus* and *Ictinia*, the Old World *Milvus* and *Haliaeetus*, and the Australian *Lophoictinia* and *Hamirostra*.

The second group comprises the ten species of fish-eagles (*Haliaeetus*, *Ichthyophaga*), which are considered to be derived

from kites, because of similarities in their morphological structure, their display flights, their feeding on carrion and some behavioural habits, notably kleptoparasitism.

The third group of 15 species of Old World vultures share consistent peculiarities related to their scavenging habits. The Palm-nut Vulture (*Gypohierax angolensis*) seems to be intermediate between fish-eagles and vultures in both food habits and anatomy. The Bearded Vulture (*Gypaetus barbatus*) and the Egyptian Vulture (*Neophron percnopterus*) show some similarities, but they may not actually be closely related. All the other vulture genera (*Necrosyrtes*, *Gyps*, *Aegypius*, *Torgos*, *Trigonoceps*, *Sarcogyps*) are more closely related to each other.

The 15 assorted snake-eagles or serpent-eagles are distributed among five genera, *Circaetus*, *Terathopius*, *Spilornis*, *Dryotriorchis* and *Eutriorchis*. They all show relatively primitive structure, bare reticulate tarsi and a high specialization on snakes. They seem to be allied to the kites, and may be convergent forms of polyphyletic origin.

The fifth group comprises the harriers (*Circus*), the harrier-hawks (*Polyboroides*) and possibly also the Crane Hawk (*Geranospiza caerulescens*). The two harrier-hawks are related to the snake-eagles. The Neotropical Crane Hawk shares many morphological traits with the harrier-hawks, including the short outer toe, the narrow head, the weak bill, broad secondaries and a long, double-jointed tarsus, but all of these features may be merely convergent adaptations to the habit of foraging in trees, and the Crane Hawk may, in fact, be closer to Neotropical hawks of the genera *Leucopternis* or *Buteogallus*. The 13 species of harriers are less specialized but they have in common a peculiar ecological niche and also similar morphological adaptations.

The large group of the sparrowhawks and goshawks, often considered the "true" hawks, includes some 58 species with rather uniform characteristics. The genus *Accipiter* is the largest in the family, and its members may range in weight from 75 g, for a small male African Little Sparrowhawk (*Accipiter minullus*), to 1400 g, for a large female of the Northern Goshawk (*Accipiter gentilis*). The genera *Urotriorchis*, *Megatriorchis*

The four members of the Old World genus *Butastur* are so closely related that they are usually considered to form a superspecies. The taxonomic position of *Butastur* is open to debate, but it appears to be intermediate between *Accipiter* and *Buteo*, so it is normally included in the rather jumbled assembly of sub-buteonine hawks. The White-eyed Buzzard is one of the three Asian members of this genus.

[*Butastur teesa*,
Madhya Pradesh, India.
Photo: J. Zwaenepoel/
Bruce Coleman]



Until recently the African Hawk-eagle was usually considered to be merely a rather well marked race of Bonelli's Eagle (*Hieraaetus fasciatus*), but studies have revealed significant differences in behaviour, especially with respect to breeding habits. Most authorities now agree that these forms are more appropriately regarded as two distinct species, although in such a case they clearly form a superspecies.

[*Hieraaetus spilogaster*,
South Africa.
Photo: Clem Haagner/
Ardea]

This Rough-legged Buzzard illustrates several of the most typical features of accipitrid head morphology: the characteristic, rather fierce expression, essentially produced by the bony shield which projects over the eye; the large, highly efficient eye; the lores covered in bristle-like feathers; the bare, often brightly coloured cere; and the long, muscular tongue. Most readily apparent is the powerful bill, which has the upper mandible longer than the lower and strongly hooked for tearing flesh; most species lack the tomial teeth found in the falcons, but the tip of the lower jaw is frequently notched.

[*Buteo lagopus*.
Photo: Robert P. Carr/
Bruce Coleman]



and *Erythrotriorchis* are specialized tropical rain forest species and perhaps primitive offshoots of the early *Accipiter*. The Gabar Goshawk is closely related to *Accipiter*, but it is often considered to be congeneric with the larger chanting-goshawks (*Melierax*), which are really more similar to the harriers. Some recent workers have associated the Lizard Buzzard (*Kaupifalco monogrammicus*) with *Melierax*, on the grounds of its plumage, behaviour and yolk colour, although it has more regularly been associated with the following group.

The seventh group, including possibly unrelated tropical genera, consists of 25 sub-buteonine hawks, which may be distinguished by their apparent affinities to any of the following natural groups. They mostly inhabit the New World (*Gerano-spiza*, *Leucopternis*, *Buteogallus*, *Parabuteo*, *Busarellus*, *Geranoetus*, *Harpyhaliaetus*), but the genus *Butastur* ranges through Africa and Asia. Another African genus, *Kaupifalco*, is frequently placed in this group, and the Grey Hawk, sometimes separated from *Buteo* in the genus *Asturina*, may be included in this group too, because of its marked resemblance to *Kaupifalco*.

Of the 28 species of the genus *Buteo*, some can be found almost everywhere, except in Australia. They present considerable evolution of shape, flight and foraging modes, from the small, relatively short-winged, long-tailed *magirostris*, *nitidus* and *platypterus*, to the medium-sized *leucorrhous*, *brachyurus* and *lineatus*, to the largest, long-winged, shorter-tailed forms like *albicaudatus*, *regalis* or *hemilasius*. The genus is sometimes subdivided, normally by placing some of the smaller forms in other genera, such as *Asturina* or *Rupornis*, but, while some kind of subdivision appears to be warranted, as yet there is considerable difference of opinion as to where the dividing line, or lines, should be drawn, so it is probably more appropriate to keep all the forms in *Buteo*, pending further investigation.

The ninth natural group comprises four large eagles from the tropical rain forests of the Americas (*Harpia*, *Morphnus*), the Philippines (*Pithecophaga*) and New Guinea (*Harpyopsis*). These birds have unfeathered tarsi and may be relicts from old lineages. They are among the largest raptors in the world.

The tenth, and final, group contains 33 species of true, or "booted", eagles, which are closely related and occur world-

wide. They are exemplified by the well known, large, generally dark members of *Aquila*. The monospecific genera *Spizastur*, *Polemaetus*, *Lophaetus*, *Stephanoaetus* and *Oroaetus* have been merged by some authors with the larger, widespread genera *Hieraetus* and *Spizaetus*. They are all regarded as the most highly evolved species in the family Accipitridae. The Indian Black Eagle (*Ictinaetus malayensis*) is tentatively placed in this group because of its feathered tarsi, its large size, its nesting habits and its display flight, but it is otherwise very different from the other species. Its very low wing-loading, long wings and short outer toe are all adaptations connected with searching for birds' nests in the tree tops. It has some osteological characters and an immature plumage that are reminiscent of those found in kites.

The business of raptor systematics remains in its infancy, so all classifications must still be considered highly provisional, as new proposals continue to be advanced. One of the most interesting to have emerged in recent years involves a group of seven or eight poorly known species that are endemic to the Australasian Region. These species of the genera *Henicopernis*, *Lophoictinia*, *Hamirostra*, *Erythrotriorchis* and *Megatriorchis*, and perhaps also *Harpyopsis*, have traditionally been scattered out amongst the kites, the "true" hawks and the outsize eagles, but it is now suggested that they are remnants of an old clade.

The Long-tailed Buzzard, of New Guinea and associated islands, has, together with its close ally the New Britain Buzzard (*Henicopernis infuscatus*), traditionally been linked with the honey-buzzards of the genus *Pernis*. However, recent opinion suggests that they may belong to an old endemic Australasian lineage.

[*Henicopernis longicauda*,
New Guinea.
Photo: Brian Coates]





The Red-backed Hawk and its apparently close relative the Puna Hawk (*Buteo poecilochrous*) both show a remarkably wide range of plumage morphs. The fact that similar colour morphs are found in both species causes considerable difficulties in field identification, and has also led to uncertainty regarding the taxonomic status and relationship of the two forms. Pale morph birds appear to predominate in the Red-backed Hawk, the smaller, lower altitude species, and it seems that rufous-backed birds tend to be females, while those with grey backs are usually males.

[*Buteo polyosoma polyosoma*, Falkland Islands. Photo: Annie Price/Survival]

or lineage, endemic to the region. These birds share numerous features, notably in plumage, whereas their relationships with other species are not at all clear. Interestingly, in mammals and also in several other bird groups, there is a similar tendency towards the existence of endemic groups in this Region. Such groups may well have arisen when Australia and South America were both part of the massive southern continent of Gondwanaland.

Morphological Aspects

The family Accipitridae presents a very high degree of diversity, encompassing, as it does, such a wide array of birds, from kites to buzzards, hawks to vultures, and harriers to eagles.

This diversity is amply illustrated by the wide range of body sizes. The smallest species is the Pearl Kite (*Gampsonyx swainsonii*) of South America which barely reaches 25 cm in total length, and 80-100 g in body mass. The males of at least three species, the Tiny Hawk (*Accipiter superciliosus*), the Red-thighed Sparrowhawk (*Accipiter erythropus*) and the African Little Sparrowhawk, also weigh between 75 g and 100 g. At the other extreme, the largest eagles, including females of large *Aquila* species, the Great Philippine Eagle (*Pithecophaga jefferyi*) and the Martial Eagle (*Polemaetus bellicosus*), range between 4 kg and 6 kg, while the Harpy Eagle (*Harpia harpyja*) and Steller's Sea-eagle (*Haliaeetus pelagicus*) weigh up to 7-9 kg; only the largest vultures (*Gyps*, *Aegypius*, *Torgos*) reach 8-12.5 kg. Most buzzards, kites, harriers and goshawks weigh between 250 g and 1300 g. Body length, a measurement little used in practice, usually ranges between 40 cm and 80 cm, and it is only very large species with long tails that reach 100-150 cm. The maximum wingspan just exceeds 3 metres in the Himalayan Griffon (*Gyps himalayensis*), and is almost as huge,

at 250-280 cm, in the Bearded Vulture and the Eurasian Black Vulture (*Aegypius monachus*). In some of the smallest species, wingspan measures under 50 cm.

A characteristic of raptors is their reversed sexual size dimorphism, the female being larger than the male, whereas in most other birds, the male is the larger sex. Many theories have been put forward to explain the evolutionary advantages of this difference. They emphasize the potentially aggressive relationships between mates, the respective roles of the male and the female in displays or brood care, or the segregation of food niches between sexes. The only indisputable argument is that the more aggressive and predatory a species is, and the more it eats birds, the greater the sexual size dimorphism. A female Eurasian Sparrowhawk (*Accipiter nisus*) may weigh up to twice as much as the male. The difference becomes less marked in species that feed mainly on rodents or snakes. It is even more reduced in those kites that eat carrion or snails, and very limited amongst predominantly insectivorous species. There is little or no dimorphism in scavengers, essentially the vultures, in which the male can even be larger than the female. Contrary to most other birds, some hawks have a sizeable right ovary, notably the members of *Accipiter*, but they lack the corresponding oviduct. This may not be related to the larger size of the female. However, in spite of the dimorphism in favour of females, there is no consistent, significant bias in the sex ratios of fledglings or adults, and an excess of males has even been found in a set of 735 broods of the Western Marsh-harrier (*Circus aeruginosus*).

The morphological attributes of accipitrids vary greatly, according to habitat, foraging mode and food type. The bill is hooked and usually strong, for tearing and pulling flesh, skin or feathers. The lower jaw is often notched at the tip to aid in cutting. The upper mandible also has a "tooth" in some kites that may be useful for breaking the neck vertebrae of prey, as



The Variable Goshawk is well named, as it probably shows more marked variety in adult plumage than any other raptor species. Some 23 races are normally recognized, and these are sometimes reckoned to constitute two or even three distinct species.

Most forms show the upperparts paler or darker shades of grey, with or without a rufous collar.

The underparts range from pure white to rich rufous or chestnut, while several races present variable amounts of barring. Just to add to the profusion of different plumages, two races are polymorphic: birds of the nominate race, from Australia, are all white, or grey above with grey and white barring below; those of the New Guinea race *leucosomus* can be all white, all dark, or grey above with rufous and white barring below.

[*Accipiter novaehollandiae*.
Photo: Dave Watts/NHPA]



Juvenile and immature plumages tend to differ conspicuously from the adult plumage, probably a mechanism designed to reduce the risk of young birds being attacked by adults that mistake them for potential rivals. The beautiful colours of the adult Bateleur contrast with the drab brown of the juvenile plumage, a plumage which probably implies a link with the Circaetus snake-eagles. Note the all black secondaries of the adult bird, indicating that it is a male.

[*Terathopius ecaudatus*.
Photo: Ronald S. Rogoff/
Planet Earth]

in the falcons (see page 221). The Hook-billed Kite (*Chondrohierax uncinatus*), the Snail Kite and the Slender-billed Kite all have a greatly elongated and hooked upper mandible, which is well designed for extracting snails from their shells (see Food and Feeding). In all species, the basal part of the upper mandible is covered by a bare, fleshy, waxy membrane, the cere, which is usually yellow, and through which the nostrils open. Its function is unknown. The lining of the gape is often conspicuous and yellow, especially in species with a wide mouth, notably eagles and the Bat Hawk (*Macheiramphus alcinus*). Vultures have the head almost totally devoid of feathers, in order to avoid staining and clotting with blood when it is inserted into carcasses, and the harrier-hawks, which dig into rotten wood and epiphytes, also have extensive bare facial skin. The lores of honey-buzzards are covered with scale-like feathers, which serve to protect the birds against the stings of wasps, on which they feed.

The tarsi of small, bird-hunting species and harriers are relatively long and thin, whereas those of eagles are stronger and thicker. In the species that kill snakes, the tarsi are covered with thick, imbricated scales that protect them against snake bites. They are feathered in eagles and two buzzard species. The feet have three toes pointing forward and one opposable hind toe, which is usually armed with the longest claw. The curved claws and the rough toe pads provide good grasping ability, especially in the fish- or snake-eating species.

The family exhibits a high diversity of wing shapes and thus a wide range of wing-loadings, the ratio of the surface area of the wing to body weight, and these factors determine the different modes of flight. Raptors have 10 primaries and 11-25 secondaries. A typical hawk's wing is long, broad, and rounded at the tip, with a pronounced chord, and several emarginated primaries, which are important in reducing turbulence and permitting a low stalling speed. Large soaring species, such as vultures, have very long, broad, rectangular wings, which are well suited to making the most of ascending air currents, and allowing the bird to soar effortlessly. The harriers have

long, narrow wings, the small kites have shorter, more pointed wings, and forest hawks have even shorter, but broader and more rounded wings. All of these groups, harriers, small kites and hawks, are adapted to flapping flight and swift pursuit of agile prey in different conditions, helped, as they are, by rather long tails, giving them improved manoeuvrability. The extremely long wings and short tail of the Bateleur (*Terathopius ecaudatus*) enable it to glide fast in a straight line, without a wingbeat, over some considerable distance.

The tail is square, rounded, wedge-shaped or even forked, and is made up of 12-14 rectrices. It tends to be much longer in forest-dwelling than in open country species, and it has become exceptionally long in some tropical forest species which never soar, such as the Long-tailed Hawk (*Urotriorchis macrourus*) in Africa, or Doria's Hawk (*Megatriorchis doriae*) in New Guinea; a long tail greatly enhances manoeuvrability. The species with a slow, soaring hunting flight must decrease their wing-loading, and they also require long tails; good examples of such species are the Red Kite (*Milvus milvus*), the Bearded Vulture and the Indian Black Eagle.

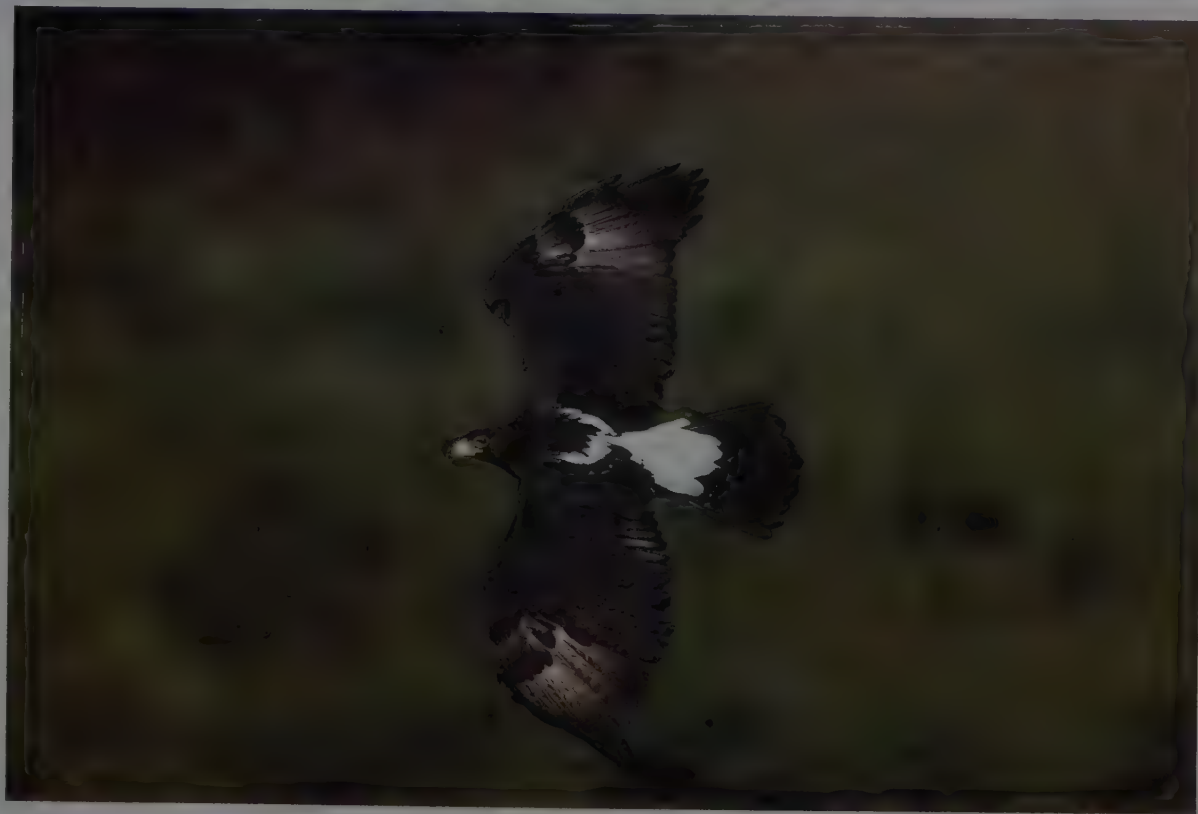
Plumage is varied in the Accipitridae, with many combinations of grey, buff and brown. There are rarely bright red or yellow parts and hardly ever the shining blues or greens found in some other birds. The ferruginous colour of the neck and underparts of the Bearded Vulture is superficial and is caused by staining with iron oxides; it is lacking in captive birds. The most recurrent plumage patterns are underparts usually paler than upperparts, pale patches on the rump, and a barred underwing and tail feathers. This pattern may make the birds less conspicuous, when seen from below. Many Neotropical forest species are either predominantly black, or, more often, strikingly white. The adaptive value of such apparently conspicuous coloration has not yet been explained, and it is interesting to note that it is hardly ever found in Old World species, the exception being the purely white morph of the Variable Goshawk. It may perform the role of signalling to reduce the need for territorial flights, as suggested by the fact that some, at any



The largest members of the Accipitridae, the larger eagles and vultures, have rather long, broad wings, which may be rounded or squarish towards the tips, in stark contrast to the pointed wings of the falcons. This design reflects a more leisurely flight style, usually involving a good deal of soaring and gliding and very few wingbeats. The tail varies from squarish to wedge-shaped, as in the White-tailed Sea-eagle, or rounded, as in Verreaux's Eagle. The rather short tail of the former corresponds to its scavenging lifestyle, while the latter, a more active hunter, requires a longer tail in order to achieve greater manoeuvrability. Note the characteristic rounded wings of Verreaux's Eagle, with the inner secondaries appearing narrow, or "pinched".

[Above: *Haliaeetus albicilla*, Japan.
Photo: W. S. Clark/FLPA.

Below: *Aquila verreauxii*,
Nairobi National Park,
Kenya.
Photo: Günter Ziesler]



rate, of these species spend lengthy periods perched on the tops of dead trees. Light and dark (melanistic), or sometimes rufous (erythristic), colour morphs occur in several harriers and buzzards, and also in some goshawks, small eagles and Neotropical kites.

The juvenile and immature plumages are most often different from those of the adults. Young hawks tend to be streaked vertically, where adults are barred horizontally. Their tails have more, narrower bars than those of adults, and they do not show marked sexual differences in plumage. In species where the adults are predominantly brown, young birds are often paler, whereas if the adults are mainly grey, or black and white, the

immatures tend to be browner. Their wing and tail feathers are often longer, or broader, than in adults, giving them a significantly more massive-looking flight silhouette than the adults, a tendency found from sparrowhawks right up to the Bearded Vulture. The end result of these modifications is probably easier flight, at the expense of reduced manoeuvrability.

That this consistent difference in plumage pattern between adults and young may be adaptive is suggested by some island forms, in which adults retain an immature-like plumage, for example the Madagascar Cuckoo-hawk (*Aviceda madagascariensis*) and the Madagascar Buzzard (*Buteo brachypterus*): some forms of selection are thought to be relaxed on islands.



Large vultures, like the Lappet-faced Vulture, tend to spend much of the day on the wing. This is mainly due to their very limited mobility at ground level, and in particular the costly business of take-off from flat ground. Once airborne, they appear rather reluctant to return to earth, and will often circle around over a located carcass for a long time before eventually descending to feed. They are heavily dependent on thermals in order to rise to any great height or cover more than the shortest of distances.

[*Torgos tracheliotus tracheliotus*,
Masai Mara, Kenya.
Photo: M. & C. Denis-Huot/
Bios]

When there is sexual dimorphism in coloration, the male is the brighter sex, whereas the female tends to resemble the immature bird in plumage. Good examples can be found amongst the *Accipiter* hawks and the harriers, in which the male is often grey, while the female is a drab brown.

The striking similarity between some co-existing, but unrelated, species is noteworthy. It may be sometimes a mere coincidence, as probably exemplified in South American forests by the Rufous-thighed Kite (*Harpagus diodon*) and the Bicoloured Hawk (*Accipiter bicolor*), or the Grey-bellied Goshawk (*Accipiter poliogaster*) and the Slaty-backed Forest-falcon (*Micrastur mirandollei*), which is actually a member of the Falconidae. In addition to the latter case, remarkably, the immature plumage of the Grey-bellied Goshawk closely parallels that of the adult Ornate Hawk-eagle (*Spizaetus ornatus*). In other cases, a potentially dangerous predator may mimic an inoffensive species and thus approach its prey more easily. The Zone-tailed Hawk (*Buteo albonotatus*) thus imitates the scavenging Turkey Vulture (*Cathartes aura*), a member of the Cathartidae, and other classic examples include the Sulawesi Hawk-eagle (*Spizaetus lanceolatus*) and the Barred Honey-buzzard (*Pernis celebensis*), or Wallace's Hawk-eagle (*Spizaetus nanus*) and the Crested Honey-buzzard.

The semi-altricial, nidicolous chicks are initially covered by a first down, which is usually white, growing from the follicles that will later produce the feathers. This is followed by a denser second down that will eventually provide the layer of down under the final plumage. After this preliminary stage, there is one complete moult every year and a progressive change towards full adult plumage over a period of one to five years, according to the age of maturity of the species involved.

Wing moult generally begins with the inner primaries and thence proceeds outwards, whereas the secondaries moult inwards starting from the outermost. In most large species, however, wing moult starts simultaneously at three or four different points, in such a way that adjacent feathers are never missing at the same time. This useful adaptation avoids seriously impeding the flight ability of these species which rely so heavily on soaring. In medium-sized species, immatures moult in the typical descendant sequence, whereas adults show the

irregular moult pattern. In temperate areas, resident birds moult in the summer, the female often doing so quickly during incubation, and the male later and more slowly, when it has been partly relieved of its hunting duties by the female. Long distance migrants, which leave soon after breeding, usually postpone their moult until they have reached their wintering grounds. In large eagles and vultures, a complete moult may extend over a period as long as two or three years, with some, but not all, of the feathers changing each year.

Many species have crests, which are probably used in displays, and these range from the few lengthened feathers of hawk-eagles to the floppy crest of the Long-crested Eagle (*Lophastus occipitalis*). Even in uncrested species, such as members of the genus *Accipiter*, the crown feathers have white bases that are conspicuous when these feathers are raised in alarm or in a threat display. A similar function is probably performed by the bare skin on vultures' heads, which may become dark red during courtship.

The flight performance of each species, along with its ability to soar with more or less help from thermal currents or wind, is controlled by its wing-loading. The heavier the species, the later it gets on the wing in the morning, the earlier it stops flying in the afternoon, and the shorter the distance over which it can sustain flapping flight. Hawks reach their highest speeds of 100-200 km/h, when diving from some height with the wings half-closed, either to catch prey, or at the end of a display flight. Some eagles stooping at prey are said to attain a speed of 300 km/h, but there are no accurate measurements of such observations. At the other extreme, several buzzards and snake-eagles readily use hovering flight to hunt over open areas, where perches are scarce. This enables them to scan the ground beneath more carefully for inconspicuous prey.

Many reactions or forms of behaviour seen in hawks suggest that they have excellent hearing, although even the most nocturnal of them, the Bat Hawk, hunts mostly by sight. The harriers, foraging over dense vegetation, have especially acute hearing which is enhanced by a well defined facial ruff and enlarged ear openings. In contrast, members of this family apparently have a poor sense of smell, and even the vultures are unable to detect a hidden carcass, unlike some members of the Cathartidae (see page 27).

Members of the Accipitridae are to be found in almost all habitat types from dense forest to open steppe. Not surprisingly, Africa, with its wealth of open or fairly open habitats, presents the widest selection of species, and even whole genera, that are adapted to such environments.

The Eastern Chanting-goshawk inhabits areas of rather dry woodland and savanna from Ethiopia and Somalia south to northern Tanzania.

[*Melierax poliopterus*, Tsavo East National Park, Kenya.

Photo: Bruce Davidson/
Survival]



Conversely, the keen vision of birds of prey is proverbial. The visual acuity of at least some hawks and eagles has been estimated at 4-8 times that of man, maybe more. The resolving power of the raptor eye is based upon relatively large size, and a high density of cones in the two foveae of the retina; this contrasts with the single fovea found in most other animals. One fovea is directed laterally, the other forwards, and this provides an unusually keen perception of distance and movement, as well as a 35°-50° field of binocular vision. Also, the muscles that control the curvature of the lens are better developed in hawks than in other birds, which allows them to have a long focal length, and the rapid, precise accommodation necessary to stoop and snatch fast-moving prey. Raptors also have the largest pectens of any birds, and these carry fin-like projections that permit a better perception of shapes. The semi-tubular eyes can not move much in their sockets, so that hawks must direct their vision by turning the head, either laterally, up to 180°, or upside down. Night vision and perception of colour are not so well developed. The iris is often yellow, sometimes orange or even red, but usually paler in young birds, and somewhat deeper in males than in females. This has been said to be of great importance for display, although some species, such as the buzzards, have brown eyes. Many hawks have a supra-orbital bony shield that may be useful in protecting the eye when the bird dashes into the vegetation after prey. The well developed transparent nictitating membrane, which can be drawn across the eyes at such moments, is an additional form of protection.

Habitat

The family as a whole has a cosmopolitan distribution. The same is also true of particular genera, such as *Accipiter* and *Circus*, which are found in most parts of all continents, except Antarctica, and on many isolated islands of all three large oceans. At the same time, at least one or two breeding species are found in every major habitat type, except the most extreme, lifeless habitats, such as the northernmost Arctic tundra, above the snowline on the highest mountains, and in the heart of the most arid deserts. Sea coasts, from tropical Asia to the Arctic,

are the home of five species of sea-eagles, and Steller's Sea-eagle sometimes even ventures quite far off the coast into the Sea of Okhotsk and the Bering Sea, to fish from drifting icebergs.

The largest number of species are found in forest and woodland, and up to 18-20 species of Accipitridae may co-exist in a limited tract of primary rain forest in South America, without considering the migrants or vagrants coming from open areas. The poorest natural habitats and the least productive, such as treeless tundras, desert steppes or alpine meadows, can usually support at best only one eagle and one buzzard species.

Open grasslands, dry or wet, flat or mountainous, are inhabited by specialized species such as the harriers, but also by several buzzards (*Buteo*) and the Steppe Eagle (*Aquila nipalensis*), all of which are adapted to nesting on the ground. As soon as trees or woodlands are found, the species richness of raptors increases, and, depending on the continent, many more kites, vultures, snake-eagles, sparrowhawks, chanting-goshawks, buzzards and eagles are added. Only a small number of these species can survive in agricultural areas, unless large tracts of woodland remain. Vast, intensively cultivated plains are now amongst the poorest habitats and the species best adapted to them are the *Elanus* kites and some harriers.

When well wooded and rich in small birds, towns, or at least suburban, residential areas, may have fairly high densities of sparrowhawks, and locally some kites or buzzards. In the tropics, for example in India or Africa, throughout urban areas where sanitation is still poor or rubbish dumps abundant, and where raptors are well tolerated, huge populations of thousands of Black Kites, Hooded Vultures and Indian White-backed Vultures (*Gyps bengalensis*) thrive, as was formerly the case of Red Kites in London, or Black Kites and Egyptian Vultures in Cairo and Istanbul.

More precisely, one must distinguish between breeding, feeding and roosting sites, as well as breeding season and wintering habitats, which may all differ substantially for a given individual. For instance, European or North American buzzards and sparrowhawks in temperate countries usually nest in woodland or forests, but they forage well outside such habitat. The same birds in winter remain mostly in farmland, gardens or lightly wooded areas, coming back to forest edge to roost. The



The Black Hawk-eagle is one of the many species that occur mainly in tropical forests. This habitat is the richest of all in terms of raptor diversity, and in South America up to 20 different species may be resident in the same tract of forest. The hawk-eagles of the genus *Spizaetus* are all essentially forest dwellers, and like the true hawks of the genus *Accipiter* they have rather broad, rounded wings and long tails, attributes that enable them to fly efficiently through the mass of leaves, branches and creepers.

[*Spizaetus tyrannus tyrannus*, southern Brazil. Photo: Luiz Claudio Marigo/Bruce Coleman]

Bald Eagle (*Haliaeetus leucocephalus*), in North America, and the White-tailed Sea-eagle (*Haliaeetus albicilla*), in Eurasia, nest along the forested banks of large lakes and rivers, but they hunt well out into open wetlands, and come back to roost in the most undisturbed forest patches.

Usually temperate migrants choose wintering habitats that are structurally very similar to their breeding habitats. The Western and Crested Honey-buzzards winter in fairly open areas of tropical forest, as does the Broad-winged Hawk (*Buteo platypterus*) in tropical America. The three migratory Eurasian harriers tend to segregate in Africa or India according to the habitat types they preferably select on their breeding grounds, with the Western Marsh-harrier occupying the wettest areas, the Pallid Harrier (*Circus macrourus*) the driest, and Montagu's Harrier (*Circus pygargus*) occurring in intermediate grasslands.

The habitat quality of both the breeding territory, and the home range used outside the breeding season, has a great influence on the density, rate of occupancy, fidelity, degree to which birds are sedentary, and breeding success of raptors. This has been shown in most detail by the long term study of different populations of the Eurasian Sparrowhawk in southern Scotland, but it is suggested for many other species by numerous studies and other, more incidental observations. The quality of a territory primarily depends on the food supply, in terms of its quantity, quality, accessibility, and the extent to which its availability is predictable through time. To a lesser extent, human disturbance, natural predation, availability of suitable nest-sites, foraging perches and shelters are also important factors. In experiments involving the removal of resident individuals, it was shown that the replacement of missing sparrowhawks in Scotland occurred quickly on good territories, but hardly ever on poor territories. Additionally, the newcomers bred less successfully than the original owners, probably because of a lack of experience with the

food resources of the territory in which they settled. Despite overall relative stability of the breeding populations, up to a quarter of the territories of Eurasian Buzzards (*Buteo buteo*) and Eurasian Sparrowhawks in Great Britain and elsewhere in Europe remain unoccupied every year.

General Habits

The daily routine of members of the Accipitridae is highly correlated with their wing-loading, the weather conditions and their food habits. Species of forests or open habitat, which mostly use flapping flight and feed on vertebrates, usually begin hunting shortly after dawn. The more insectivorous species often do not become active until 1-2 hours later, even in the tropics. Species which use soaring flight for hunting are the latest to take off, since they must wait for the building up of warming air currents. A reversed timing pattern is observed in the late afternoon, except for some tropical kites which regularly take advantage of swarming insects at dusk. The heat around midday, especially in the tropics, marks the period of lowest activity for many, if not all, species. During rainy periods, most raptors stop hunting, or at least flying, and long wet periods, such as rainy springs in temperate countries, or the height of the rains at tropical latitudes, act as a limiting factor for many species.

Each species requires a certain amount of time in order to meet its daily food requirements: the smaller the prey, the longer the time that must be spent hunting. On their wintering grounds, large insectivorous species, such as Swainson's Hawk (*Buteo swainsoni*) or the Steppe Eagle, must spend several hours daily foraging actively, whereas similar-sized eagles or goshawks may need only one large prey item every three or

four days, so they may spend much less time hunting. Vultures that have gorged themselves on a carcass may subsequently fast for up to a week or more. During the northern winter, raptors tend to use the relatively short daylight period more fully, and to concentrate more exclusively on hunting than they do during the long summer days. No accipitrid species is really active before dawn, as are the forest-falcons (*Micrastur*) of the Falconidae, and, indeed, very few are even crepuscular on a regular basis. Only the Bat Hawk hunts around dusk, but it too stops soon, once it becomes too dark for it to see its prey. The Letter-winged Kite (*Elanus scriptus*) of Australia is exceptional in that it mostly hunts nocturnal desert rodents and regularly does so not only at dusk, but also well into the night, when there is enough moonlight. Vultures have sometimes been seen feeding on carcasses on moonlit nights.

Probably because flight is costly, many raptor species spend a large portion of the day resting, or at least not moving actively. During these loafing periods, they may watch their territory from a vantage perch, or even wait for an opportunity to catch some easy prey, as it passes by. At such times, a bird will often stand on one leg, with the other drawn up into the belly feathers. Before flying again, a bird often stretches its wings and legs, and this is especially true of the larger species.

Preening is also a time-consuming activity in raptors. Many species like bathing when water is available, but most of them rarely, if ever, drink, at least in natural conditions, except carrion-eating species, which do so regularly. In several species, sunbathing is observed occasionally during the day, but it is frequent in early morning, when birds make a practice of spreading their wings in the first rays of the sun. Similarly, they do so in the wind after rain storms, often drying their wings on an exposed perch. In all these circumstances, tropical forest species use emergent dead trees, and at such moments they become conspicuous.

True playing activities are not often recorded, or at least recognized as such, but they doubtless occur, especially in young birds. Even the vigorous wing flapping and jumps of fledgling hawks on the nests may not only be useful training to develop flight muscles, but also a form of play, as are attempts

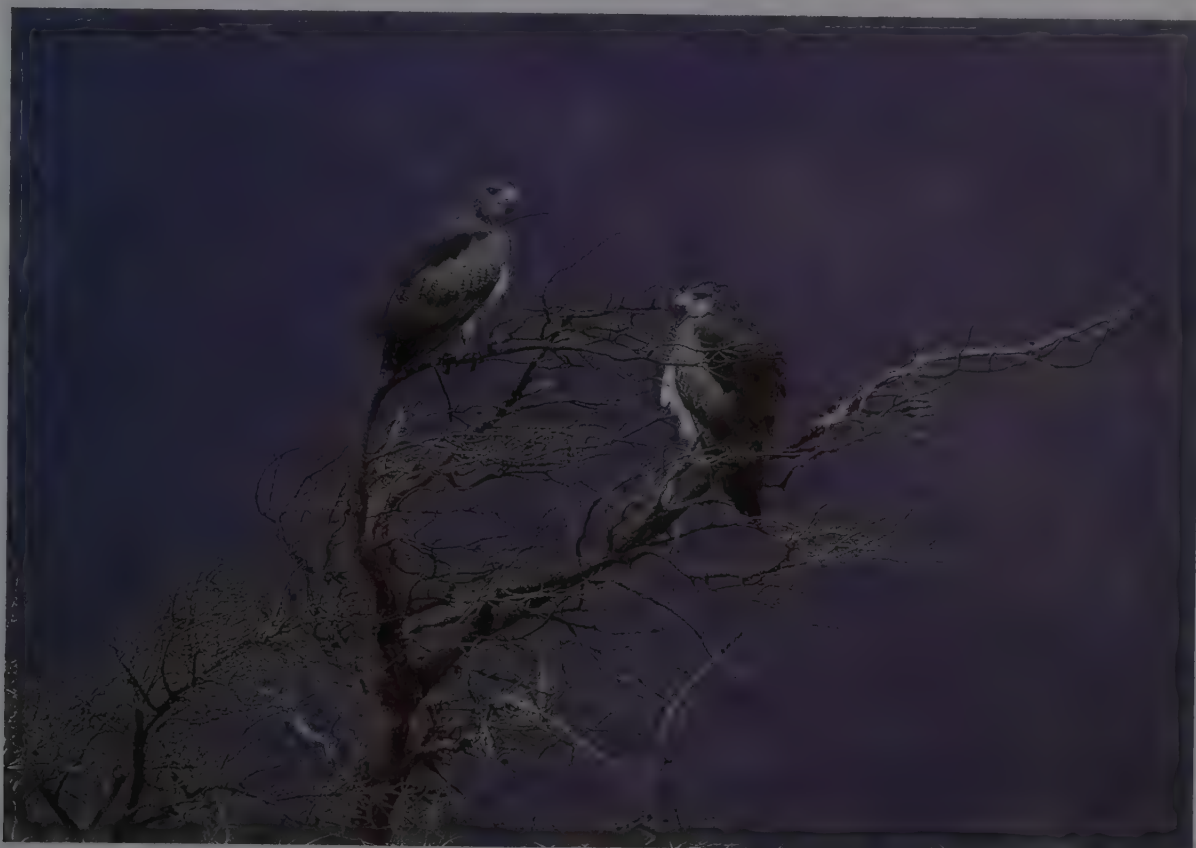
to catch flies. When the weather is fine, large-winged species often spend considerable time soaring, without any obvious motivation other than pleasure, even if this may also serve as a territorial display. Nevertheless, in the Chihuahuan Desert of northern Mexico, in summer, Swainson's Hawks regularly spend hours soaring very high in the early afternoon over their territory, apparently to avoid the excess heat at ground level.

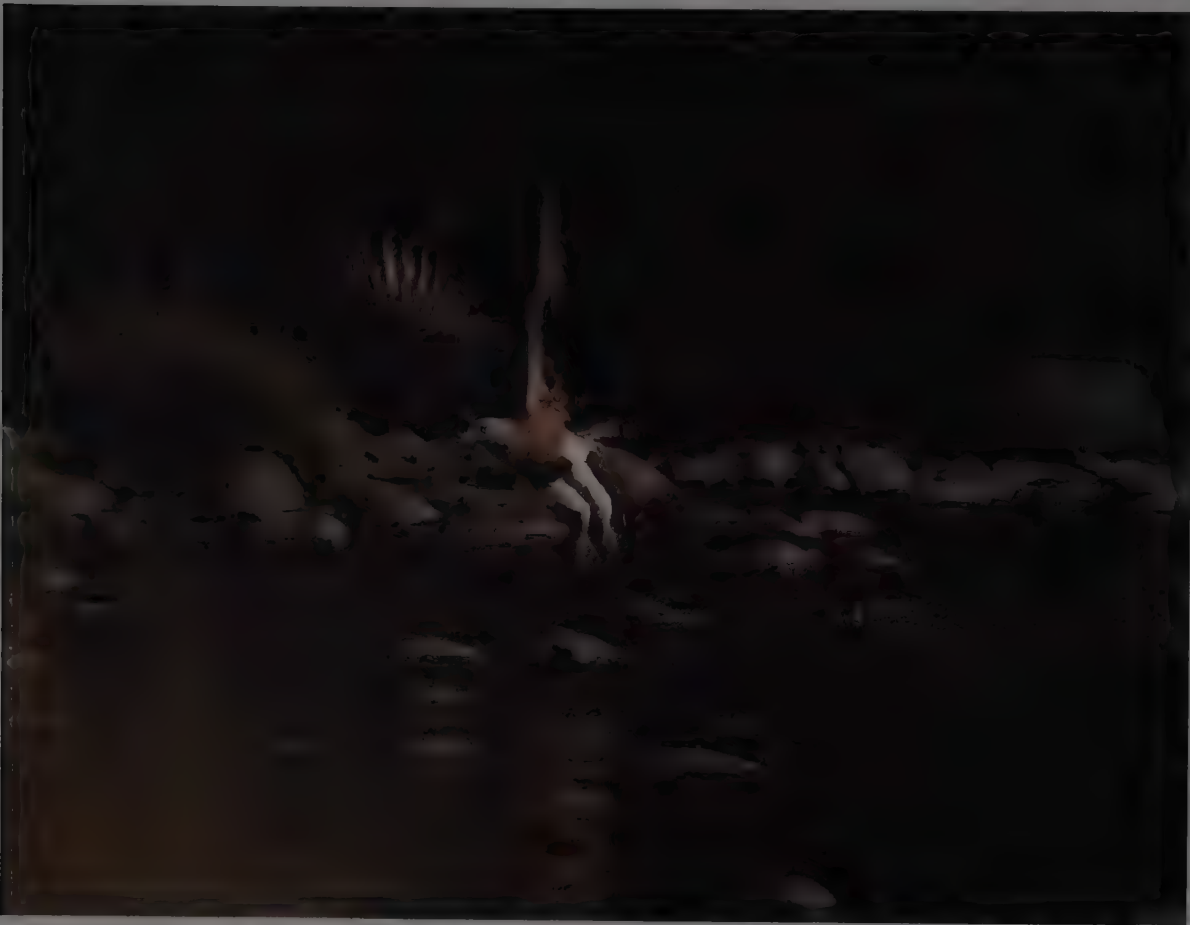
One of the most important life history traits of raptors is their territorial behaviour. Predators of vertebrates must have the exclusive use of a sufficient hunting range to ensure a steady food supply. The most typical situation is that of resident pairs spaced out in individual home ranges that are defended almost entirely. In many species, however, the nest and its immediate surroundings are more actively defended than the outer parts of the territory, within which certain areas are much more frequently visited than others. undefended parts of a home range may overlap with similar areas of neighbouring ranges. Hunting home ranges of breeding pairs vary much in size, depending on the density of prey: 50-150 ha in sparrow-hawks and small to medium-sized buzzards; 200-400 ha in harriers and larger buzzards; and 1000-2000 ha in small eagles, the Northern Goshawk, or larger species, like the Crowned Hawk-eagle (*Stephanoetus coronatus*) in a prey-rich forest in Kenya. The large eagles, from Scottish moorlands to African savannas and Amazonian rain forests, have home ranges covering 2500 to 10,000 ha and sometimes more. Intensively studied pairs of Bald Eagles in the United States have mean home ranges of 2200 ha, with extremes of 600 ha and 4700 ha. Under exceptionally favourable conditions, some large raptors may have surprisingly small territories, for instance 100 pairs of African Fish-eagles (*Haliaeetus vocifer*), along the Kazinga Channel in south-central Uganda, had contiguous territories that never exceeded 20-50 ha each.

The maximum hunting range of breeding birds may be somewhat larger than expected from the area known to be used regularly. Eurasian Sparrowhawks have been recorded up to 9 km from their nests, Montagu's Harriers 12-14 km away. Red Kites more than 15 km away, and Verreaux's Eagles (*Aquila verreauxii*) up to 27 km away. Eurasian Griffons (*Gyps fulvus*)

Several birds of prey are to be found mainly in mountainous areas, where they are usually able to take advantage of updraughts and strong winds for soaring flight. The Black-chested Buzzard-eagle is a typical denizen of the Andes, ranging from the foothills up to about 4600 m, although in the south of its range it generally occurs at much lower altitudes.

[*Geranoaetus melanoleucus australis*, Torres del Paine National Park, Chile. Photo: Günter Ziesler]





Some raptors are closely linked with aquatic habitats, most notably the fish-eating eagles of the genera *Haliaeetus* and *Ichthyophaga*. While the eight members of the former are most typically associated with sea coasts and very large inland water bodies, such as lakes and marshes, the two members of the latter are more commonly seen along rivers or even streams. The Grey-headed Fishing-eagle occurs in lowland areas from India east to the Philippines and Sulawesi.

[*Ichthyophaga ichthyaetus*, Corbett National Park, Uttar Pradesh, India. Photo: Günter Ziesler]

in Europe, Rüppell's Griffons (*Gyps rueppellii*) in East Africa, and Cape Griffons (*Gyps coprotheres*) in South Africa are all known at times to search for food more than 100 km away from their nests.

Within the home range, there may be a marked shift of preferred hunting areas between days or seasons, male and female, young and adults. The area used also tends to be larger during the fledging period, when the food requirements are highest, and in winter, when prey density is lower. In the colonial breeders, the *Gyps* vultures, or in occasionally gregarious species, including some kites and harriers, only the nest-site is defended during the breeding season, so that most of the foraging area is shared with other individuals. There, birds may hunt alone, as do the Black, Red and Letter-winged Kites and Montagu's Harrier, or gregariously, as regularly occurs in the American Swallow-tailed Kite (*Elanoides forficatus*), the African Swallow-tailed Kite (*Chelictinia riocourii*) and the Mississippi Kite (*Ictinia mississippiensis*). In resident species, pairs remain on their territory all year round, but in migratory or nomadic species, birds return to take over the same territory every year. Some wintering birds may settle in temporarily defended feeding territories.

Most of the colonial or semi-colonial species tend to spend the night in communal roosts, as do also solitary breeders that become gregarious on winter feeding grounds, for instance the Bald Eagle, Steller's Sea-eagle, the White-tailed Sea-eagle and the Steppe Eagle. These roosts take place in trees, cliffs or marshes, and the same site is regularly used, sometimes involving up to 1000 birds, or more, as is the case of Montagu's Harrier in West Africa. At such sites, when the birds feel secure, they drop into a deep sleep, with the head tucked under the scapulars.

As they are often fierce and aggressive, most raptors exhibit little elaborate social behaviour. The permanently gregarious vultures, which both breed and feed communally, have spectacular aggressive displays around carcasses which are intended to enforce their dominance over conspecifics or other birds.

Gregarious species that flock where food sources are abundant, for example kites or Swainson's Hawks, do not show any form of co-operation between individuals. Nor do the buzzards or eagles, which are so highly gregarious during migration, but which often disperse and remain solitary once they have arrived in their winter quarters, as exemplified by honey-buzzards and the Broad-winged Hawk. Multispecies flocks, or feeding aggregations of up to several hundred raptors of numerous species, commonly occur at concentrations of easy prey, such as swarms of locusts or termites, breeding colonies of queleas (*Quelea*), seasonal bushfires, and the like, but each species forages independently of the others, and rare signs of agonistic



The Black-faced Hawk is one of the many tropical forest raptors about which virtually nothing is known, a reflection of the host of difficulties that complicate the study of shy, inconspicuous species in such an environment. This bird was momentarily disturbed while eating a snake on the forest floor, but it quickly returned to its meal.

[*Leucopternis melanops*, Cuyabeno National Park, Ecuador. Photo: Isabel Martínez]

Bateleurs frequently spend most of the day in flight, but, like this immature bird, they often land at water-holes, where they may stay for several hours, resting, drinking and preening. Sunning is common behaviour in many species, notably vultures, and mainly takes place in the early morning, in the sun's first rays. One of the main purposes of this behaviour, at any rate in some species, is to tone up the feathers and bring them back into perfect shape, after they have been distorted by the considerable pressure exerted during long periods of soaring.

[*Terathopius ecaudatus*,
Kalahari National Park,
South Africa.
Photo: Jeremy Woodhouse/
DRK]



behaviour involve mostly the adults' demonstration of their dominance over immature birds.

Territorial or nuptial display flights are a fundamental component of intraspecific relationships. Primarily during the breeding season, but also in other months in the tropics, pairs of territorial adults, or lone males, perform characteristic, and often spectacular, courtship display flights, mostly above and around the nest-site. This usually takes place in mid- or late morning, or much less frequently in the afternoon. This can be the best way to detect many otherwise secretive tropical forest species, which soar above the forest almost every day, but often only once a day, and for a short period, so as to reassess their territory ownership and signal their presence to their neighbours, or to potential intruders. Curiously, it is only at dawn and dusk that the African Goshawk performs its display flight, with an endlessly repeated, monosyllabic call, quite unlike that of any other raptor.

Open country species soar and display more often, and during a longer part of the day than do forest species. Temperate species tend to perform displays more extensively than many tropical species. Aggressive interactions between a territory owner and an intruder may sometimes end in so-called "cart-wheeling" flights, where the two birds, grasping each other's talons, plummet down, with their feet locked, whirling round together. This may also occur as a form of play behaviour between young birds, or during parent-offspring conflicts, but injuries are rarely reported. Many interactions, however, are resolved by visual signals, thereby averting the need for direct confrontations. Such signals may involve the brightly coloured plumage of adults being displayed at conspicuous perching sites, or, at closer range, an erected crest or showing off the deeply coloured facial skin.

Interspecific competition between raptors may operate through aggressive interference, displacement from the nest-site or mutual avoidance. The Golden Eagle (*Aquila chrysaetos*) often excludes Bonelli's Eagle from small cliffs,

and the latter persistently harasses Eurasian Griffons, if they are near its nest-site. In the Chihuahuan Desert of Mexico, Swainson's Hawks and Red-tailed Hawks (*Buteo jamaicensis*) maintain exclusive territories centred on their respective preferred habitats. In the rain forest of French Guiana, the territories of the Harpy Eagle and the Guiana Crested Eagle (*Morphnus guianensis*) rarely, if ever, overlap, though they may be contiguous. Breeding pairs of Bald Eagles, and probably of other sea-eagles, reduce the number of Ospreys in their territories, maybe because they systematically harass any Osprey carrying a fish, in order to steal it.

Voice

Most species in this family are quite vocal during the breeding season. Usually, loud vocalizations are associated with behaviour related to reproduction, aerial displays, copulation, brood care, the pair-bond, territorial defence and aggression. In contrast, birds are often almost silent outside the breeding period, during migration or in winter. At these times, even among large feeding flocks, or at night roosts of buzzards, kites or harriers, when there are multiple opportunities for interactions between individuals, it is rarely possible to hear more than the occasional, brief call.

Considering the family as a whole, vocalizations are very varied, with screams, croaks, whistles, mews, barks, yelps, cackles, and many more noises recorded. However, any trained ornithologist can easily tell most raptor calls from those of almost any other kind of bird. Moreover, the repertoire of most individual species is rather limited and constant.

Voice characteristics are difficult to describe or render in words. Very roughly speaking one can just say that the usual calls of sparrowhawks, goshawks and several small kites amount to a quickly repeated chattering or clicking vocalizations, sometimes wailing or shrilling, with a perceptibly

different tone between the male and the female. Harriers, especially during courtship, utter either rapid chattering or cackling calls, in the "grey" harriers, or wailing, prolonged, high-pitched calls, in the marsh-harrier group. Kites, at any rate those of the genera *Milvus* and *Haliaeetus*, are often more vocal than other raptors and make various loud mewing, whistling, whinnying and even trilling calls.

The buzzards (*Buteo*) are also quite vocal and their plaintive mewing, screeching or sometimes squalling voice is well known. The large *Aquila* eagles utter repeated harsh, deep, barking or yelping calls in display, but various faint, chirruping calls are also used between mates. The hawk-eagles of *Spizaetus* and associated genera, and also the genus *Hieraaetus*, tend to have clear courtship display calls, that are louder and more musical than those used by *Aquila*, and are not unlike the almost melodious whistles of honey-buzzards (*Pernis*) or serpent-eagles (*Spilornis*). The snake-eagles (*Circaetus*) have both clear, musical whistles, that recall those of orioles (*Oriolus*), and also deeper, harsh, repeated notes that are used during aggressive encounters. Finally, vultures merely emit a series of grunts or croaks, as well as the hisses, screeches and goose-like, or high-pitched, chatters that are typically heard during agonistic interactions around carcasses. Chicks and fledglings of all species make higher-pitched, shrill calls, and chicks still inside the egg will even produce piping or cheeping sounds, sometimes several days before hatching.

Vocalizations play a crucial part in several forms of behaviour. They are primarily important in both courtship and aggressive behaviour, and are associated with the visual displays or postures that are used to attract a mate, to reinforce the pair-bond, to invite mating, to chase intruders, and in nest or territory defence. Accordingly, they may be classified into courtship, contact, advertising, alarm, threat or mobbing calls. Food-related calls are equally important, either when the female solicits food from the male, or when fledglings are begging for food from their parents. When young birds are flying, dis-

persed, around the nest, but are still dependent on prey brought in to them by the adults, their very distinctive persistent, far-carrying vocalizations motivate and help the adults to locate their offspring and provide them with food, while, at the same time, the young birds must remain inconspicuous to any potential predators.

Calls are loud and harsh when alarm or aggression are involved, but much softer during pair-bond interactions at the nest. Some species have a genuine song, with all the characteristics of the classic song of passerine birds, in that it is loud and musical, and is uttered from a prominent perch, mainly during the breeding season, by territorial males only. A good example is afforded by the Lizard Buzzard, which breeds in wooded savannas throughout much of Africa. The far-carrying calls of non-soaring raptor species in the dense understorey of rain forests may also have the same function and significance, for instance the small *Leucopternis* hawks of South America, and the Long-tailed Hawk and the Congo Serpent-eagle (*Dryotriorchis spectabilis*) in Africa. Yet there are several rain forest species that, as far as is known, seem to have neither the loud vocal, nor the spectacular but silent, display flights of many eagles; nor do they produce the resounding song or even the loud calls of the aforementioned species. These include both small and large birds of prey, for instance the Rufous-thighed Kite or several small *Accipiter* species, and, at the other extreme, the Harpy Eagle. The vocal, social and communication behaviour of such species would be well worth investigating.

Food and Feeding

The types of food used by the members of the family Accipitridae are as diverse as the species themselves, and every major group of vertebrates and even invertebrates is included in the diet of at least one species.



The African Little Sparrowhawk is frequently found in the vicinity of water. Like many other members of the Accipitridae, it is not averse to a session of bathing, when it may crouch down, puff out its breast feathers and wriggle its wings vigorously in order to spread the water all over its plumage; this process can be repeated intermittently for about 20 minutes and may be combined with drinking. After bathing, birds sometimes rest in the sun, giving their plumage time to dry out.

[*Accipiter minullus*, Zululand, South Africa. Photo: Nigel Dennis/NHPA]

During the winter, most of the aggressive encounters that take place between Eurasian Buzzards correspond to disputes over food. Rivals threaten each other by adopting the "Angel Posture": the wings are thrown up and sometimes twisted inwards to highlight the striking underwing pattern; the head is thrust backwards, with the bill pointing down; the feathers of the crown and nape are bristled up, and those of the breast puffed out; talons can be presented; and the legs may be stretched too, as each bird attempts to appear larger, bulkier and taller than its rival. Disputes are typically accompanied by calling, and in most cases one bird submits and backs down in response to the threats, but fights can ensue, on occasions even leading to deaths. Larger birds tend to win such disputes.

[*Buteo buteo*.
Photo: Manfred
Danegger/NHPA]



Most species are exclusively carnivorous, but several, such as the American Swallow-tailed Kite, occasionally eat fruit, and this may be more frequent in tropical forests than the sparse records actually suggest. The fruits of the oil palm (*Elaeis guineensis*) are a constant base of the diet of the Palm-nut Vulture, which also frequently takes fish from lagoons and rivers, and many crabs in mangroves, as well as some carrion; the fruits of both larger (*Raphia vinifera*) and smaller palms (*Phoenix reclinata*) are also regularly consumed, and, like the nuts of the oil palm, they are rich and oily, but with a large kernel and little pulp; few fruits, other than those of palms, have been recorded in the diet of this species. Nevertheless, a study of breeding raptors in West Africa, in the wooded savanna at Lamto, central Ivory Coast, showed that two other, rather unexpected species, the Black Kite and the African Harrier-hawk, also included a high proportion of oil palm fruits in their diet, and even brought them in large numbers to their nests to feed the young, a remarkable practice, given that it would seem energetically unprofitable to carry in such largely indigestible fruits, one by one.

Invertebrates are a favourite food, because they are often abundant and are easy to catch. Among the 237 species in this family, 12 are almost exclusively dependent upon insects, 44 are largely insectivorous, at least outside the breeding season, and maybe up to 100 additional species may take some occa-

sionally. Locusts, grasshoppers and other Orthoptera are the most frequently taken insects, along with the flying alates of ants and termites, when they swarm after heavy rains. Alates are so attractive to the raptors that even Steppe Eagles, large birds, when wintering in southern Africa, feed mainly on them, although several hundred individuals of such a tiny form of prey are necessary to supply the energetic equivalent of a single mouse. A sudden profusion of beetles or the pullulations of almost any other medium-sized or large insect are exploited opportunistically by many birds of prey. Huge concentrations of predators, including many hawks, kites and eagles, follow the swarms of locusts in the Old World tropics, or attend bush fires, where they catch far more insects than vertebrates.

Many forest raptors specialize on particular kinds of insects. For instance, the main sources of food for all honey-buzzards in Eurasia are bee and wasp nests, which the birds dig out of the ground or tree holes, and from which they eat some honey and a few adults, but where they carefully pick out the larvae one by one. The African Cuckoo-hawk (*Aviceda cuculoides*), the Pacific Baza (*Aviceda subcristata*) and the Black Baza (*Aviceda leuphotes*) feed largely on insects, especially caterpillars which are taken from in amongst the foliage, as the birds move slowly along, watching intensely, like cuckoos, so as to detect their highly inconspicuous prey. The Double-toothed Kite (*Harpagus bidentatus*), which is less spe-



Concentrations of over 100 vultures can gather around a carcass, and in such cases competition for food is fierce, with a ceaseless string of squabbles. It may all appear to be a wild battle amongst a noisy mob, but, in fact, each individual gains access to the food in a co-ordinated sequence, which is strongly influenced by its hunger, its social rank and its body size. Fighting can be very violent, as vividly illustrated by these two African White-backed Vultures. Note the larger, orange-billed Rüppell's Griffons (*Gyps rueppellii*) in the background.

[*Gyps africanus*,
Masai Mara, Kenya.
Photo: Günter Ziesler]

cialized, regularly follows troops of monkeys to catch the fleeing insects that are disturbed and thus made visible, when the primates shake the branches. The American Swallow-tailed Kite and the Plumbeous Kite (*Ictinia plumbea*) often almost exclusively hunt high-flying insects above the canopy of Neotropical rain forests.

Other arthropods are occasionally caught, but high specialization occurs only on crabs, notably by the Rufous Crab-hawk (*Buteogallus aequinoctialis*) in the mangroves of South America. Snails are the exclusive food source of the highly specialized Neotropical species, the Snail and Slender-billed Kites, which feed on water snails, and the Hook-billed Kite, which takes arboreal snails, sometimes in surprisingly dry forests. Several species take earthworms when they are easily available; for example Black and Red Kites take them on recently ploughed fields, as does the Eurasian Buzzard on waterlogged meadows in the autumn.

Few species are highly specialized on fish, and they all catch them near the surface of the water. The Lesser Fishing-eagle (*Ichthyophaga humilis*) and the Grey-headed Fishing-eagle (*Ichthyophaga ichthyaetus*), in Asia, and the Black-collared Hawk (*Busarellus nigricollis*), in America, are the typical fish-eaters of tropical inland waters. From African lakes and south Asian sea coasts to the Arctic Circle, the eight species of fish-eagles are primarily piscivorous, but they take mostly dead or particularly vulnerable fish. Spectacular seasonal concentrations occur where such food is abundant, and over 2000 Bald Eagles may gather at the autumn spawning runs of anadromous salmon on the Chilkat River in Alaska, while similar numbers of Steller's Sea-eagles collect in winter to feed on discarded fish and offal, off the north coast of Hokkaido, Japan. Several other species take fish on a regular basis although it only constitutes a part of their diet, as in the case of the Black Kite, the Palm-nut Vulture and the Common and Mangrove Black Hawks.

Amphibians, lizards and their allies are hunted by a wide variety of species that also tend to take insects or higher vertebrates. They are not only caught on the ground, but also on trees by several tropical forest sparrowhawks (*Accipiter*), and likewise by unspecialized canopy dwellers, including *Harpagus*, *Leucopternis* and *Aviceda*; they are also taken from tree

holes and epiphytes by the Crane Hawk and the harrier-hawks. The Eurasian Buzzard regularly eats poisonous toads, just removing the toxic skin off the back.

Snakes are the main, if not the only, prey of the Old World snake-eagles (*Circaetus*) and serpent-eagles (*Spilornis*, *Dryotriorchis*) and also of the ten species of New World hawks of the genus *Leucopternis*; the very limited information available to date does not confirm the presence of snakes in the diet of the Madagascar Serpent-eagle (*Eutriorchis astur*). The majority of these reptile predators are forest or woodland species, which use long periods of quiet perch-hunting to detect their highly cryptic prey. In the American rain forest understorey, the White Hawk (*Leucopternis albigollis*) regularly follows the troops of capuchin monkeys (*Cebus*), to catch the tree snakes that they disturb and that are otherwise very difficult to see. Snake-eagles hunting in open habitats use long periods of hovering flight to search efficiently for cryptic snakes. Many other species occasionally take some reptiles, both arboreal and terrestrial, or even sea-snakes in the case of the White-bellied Sea-eagle (*Haliaeetus leucogaster*). Poisonous species are caught indiscriminately, although no raptor species seems to be immune to their venom. Instead, all rely on their agility, and their ability to grasp and break the head or neck of a victim first, and thus avoid bites. Snake-eagles carry their victims to the nest partly swallowed, head first, with the tail protruding out between the mandibles. In contrast to this, serpent-eagles often carry their prey in the feet, presumably because these species are less exposed to kleptoparasitic attacks in their forest habitat. Even tortoises are eaten, and on several occasions I have seen Golden Eagles in Greece dropping them onto rocks to break their shells.

At least 25 species of sparrowhawks and goshawks (*Accipiter*), several other forest hawks, some buzzards, including the Short-tailed Hawk (*Buteo brachyurus*), and the hawk-eagles (*Spizaetus*) are specialized on birds. Prey species range in size from very small hummingbirds (Trochilidae), which are said to be a common prey of the Tiny Hawk, to large game birds of the Cracidae, Phasianidae or other related families. Birds are also taken in various proportions by a wide range of other raptors, including kites, harriers, chanting-goshawks, buzzards and eagles. Local concentrations of small birds, such as the

dense breeding colonies of granivores and large roosts, regularly attract a number of predators, including bird-hunters, unspecialized nest robbers and some scavengers.

Eggs and fledglings are taken opportunistically by many generalist species, but at least one, the Indian Black Eagle, is a specialist predator of birds' nests, which it searches for carefully in the tops of trees. Even the breeding colonies of large waterbirds are raided by several species of *Haliaeetus*, *Buteogallus*, *Hieraetus* and *Aquila*. In East Africa, Egyptian Vultures have learnt to break the hard shell of Ostrich (*Struthio camelus*) eggs by throwing stones onto them, a classic case of tool use by animals.

Small mammals are a favourite prey of many species, because of their abundance, ease of capture and energetic reward. They are the main prey of a fair number of species from kites (*Elanus*) to buzzards (*Buteo*), and the abundance of voles, mice or lemmings strongly controls the density and breeding success of their main predators. Some such predators are nomadic and breed only where and when there is an outbreak of rodents, notably the Rough-legged Buzzard (*Buteo lagopus*) and the Letter-winged Kite. Larger rodents, such as rabbits in Europe and Australia, susliks in Central Asia, hares in North America, and rock hyraxes in Africa, have the same effect on the density and reproduction of many eagles. The larger eagles commonly kill mammals up to the size of adult monkeys, goats, lambs or small antelopes, but they are unable to fly off with a carcass heavier than their own weight, which is usually less than 4-5 kg. Bats are incidentally caught by some species, but the Bat Hawk has developed a unique specialization, hunting them in flight, at dusk and dawn, and being able to kill and swallow several individuals in quick succession.

The last widespread source of food is carrion. Of course, it is the only diet of vultures, but many other species eat some carrion occasionally, or even regularly, during periods of food scarcity. In winter, White-tailed and Steller's Sea-eagles rely a great deal on dead fish, birds and mammals. Among the vultures, there are specific differences in the use of carcasses, depending on the body and bill sizes of the species involved. The griffons (*Gyps*) primarily eat flesh and viscera, but the

larger species (*Aegypius*, *Torgos*, *Sarcogyps*) also make use of hard parts, including skin, sinews and some bones, while the smaller Egyptian and Hooded Vultures do not have the wherewithal to open large carcasses themselves, and mostly wait for scraps left by the other, dominant species. The Bearded Vulture is a well known specialist of bones, but it does not search only for their marrow. It swallows surprisingly large chunks of bone whole, and breaks the larger bones by dropping them on rocks. Its stomach content is still more acid than that of other raptors, and this helps the bird to digest the bones and use their protein efficiently. Conversely, this species lacks the distensible crop that other vultures have for food storage. Finally, animal dung is commonly eaten by the Egyptian Vulture, and the Hooded Vulture even eats a good deal of human excrement in and around African towns.

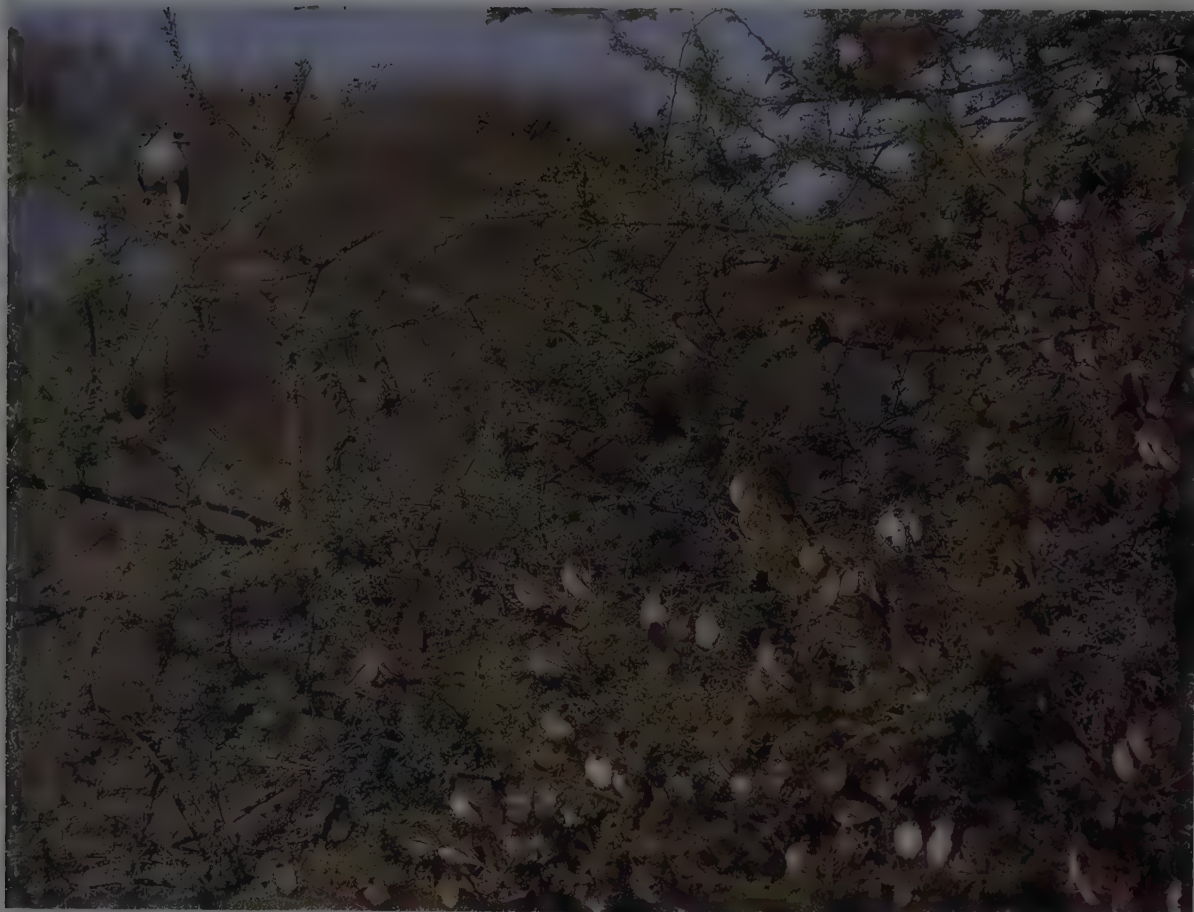
Accipitrids use several hunting techniques, in accordance with their habitat structure, prey type and morphological adaptations. The most widely used, and energetically least expensive, is perch-hunting. A bird waits immobile on a perch, gazing intently about, and making short dashes out, usually to catch small prey on the ground a short distance away. Some species also walk for long periods before going back to their perches, for instance the chanting-goshawks, the Lesser Spotted Eagle (*Aquila pomarina*) and the Steppe Eagle. The Black Kite, the Brahminy Kite (*Haliastur indus*), the piscivorous *Haliaeetus* and *Ichthyophaga* eagles and the Black-collared Hawk all detect fish more often from a perch than in flight, and will snatch it from just below the surface of the water, without diving, unlike the Osprey (see page 45). When available, these species prefer dead or stranded fish.

Slow soaring and hovering have similar advantages to perching, as they facilitate the detection of inconspicuous or unsuspecting prey. These methods are practised by a selection of large winged hawks, buzzards, kites and eagles, when hunting over open grasslands. A quite different technique is that of ambush, which involves a hawk waiting, hidden in a tree, whence it can dart forth with surprising swiftness and agility at a passing bird. This is the favourite hunting method of sparrowhawks and goshawks, which rely on the element of surprise

Most members of the Accipitridae are to be heard calling during the breeding season, but they tend to be largely silent at other times of year. A notable exception is provided by some of the large fish- or sea-eagles of the genus *Haliaeetus*, which call far more regularly throughout the year. The voice of the Bald Eagle can be described as a harsh cackling, which is deeper and more raucous in the larger female than in the male, a tendency also noted in some other members of the genus.

[*Haliaeetus leucocephalus*.
Photo: Glen Elison/FLPA]





The Gabar Goshawk feeds mainly on small birds of less than 80 g. This particular individual has alighted on an Acacia, in which there is a large flock of Red-billed Queleas (*Quelea quelea*), a superabundant agricultural pest species. The goshawk selects a victim and then pounces. The hunting technique used by this species, involving a very rapid, agile chase, contrasts markedly with the far more static perch-hunting system prevalent amongst the chanting-goshawks (*Melierax*). This, together with the fairly short wings, long tail and long toes of *Micronisus*, suggests that it is probably more closely related to the genus *Accipiter* than to *Melierax*.

[*Micronisus gabar*,
Etosha, Namibia.
Photos: Günter Ziesler]

Golden Eagles usually prey mostly on medium-sized mammals, such as rabbits, hares and some rodents, although gamebirds can also be important. In some cases, however, carnivorous mammals such as mustelids, cats and even foxes may be taken on a regular basis. The eagle normally catches its prey by striking at it on the ground from a rather low quartering flight. In certain areas, and especially in winter, carrion can make up a significant proportion of the diet of this species.

[*Aquila chrysaetos homeyeri*.
Photo: José Luis Rodríguez/
Nature & Travel]



to catch their prey. Quartering, by means of slow, buoyant flight low over the ground, similarly allows the harriers to surprise rodents and birds in open areas. Active hunting in flight is typical of insectivorous kites of the genera *Elanoides*, *Chelictinia* and *Ictinia*, and also of the Bat Hawk, which has a much more rapid, powerful flight. All these species have the rather pointed wings of swift fliers like the falcons.

In order to find carcasses, vultures rely not only on their excellent eyesight, but also on the findings of congeners or other species. Within a radius of several kilometres around it, and while flying about at 200-2000 m, each individual follows the movements of other vultures descending toward potential food.

Social or co-operative hunting has been documented in several buzzards and eagles. It occurs between mates with strong, permanent pair-bonds, and increases the success rate of attacks on large, swift vertebrates. Pairs of White-tailed Sea-eagles succeed in catching wounded waterbirds, which dive repeatedly at each attack of the eagles, but which become exhausted when they can neither breathe nor rest between two dives. Co-operative hunting involving more than two individuals has been described in social groups of Harris's Hawks (*Parabuteo unicinctus*), and it is known to allow this species to take larger prey with more success than if the birds were hunting alone. Groups of two to six individuals gather at dawn, and usually break up into sub-groups which "leap-frog" through the hunting territory, 100-300 m at a "hop", attempting to flush and ambush rabbits. Several birds perch nearby, while one or more birds dive into cover, where prey has gone to ground. Another system used by Harris's Hawks involves relay chases, whereby one bird failing in a capture attempt is replaced by another member of the group. Team hunts with five to six birds are the most successful, and often result in the capture of

sufficient prey to meet the energy requirements of all the individuals in the group.

Piracy, entailing the stealing of food items from other birds, including conspecifics, is common among kites, fish-eagles, the Steppe Eagle and the Tawny Eagle (*Aquila rapax*). Many other species, however, occasionally indulge in kleptoparasitic attempts, and immature birds tend to do so more persistently than adults.

The speed of raptors hunting actively, flying in a straight line, ranges from about 15-30 km/h for harriers, foraging 0.5-3 m above the ground, to 50-80 km/h for the Bateleur, flying at a height of 50-100 m. Vultures and eagles, gliding down over long distances, may reach speeds of 90 km/h or more. Eyesight is by far the most important sense used in hunting, but hearing is also regularly used, as shown by the fact that raptors are attracted by the calls of their prey species, produced naturally or imitated, and sometimes by the noise of distant gunshots, when they may try to retrieve dead or wounded game. The visual acuity of many species (see Morphological Aspects) is an essential part of their hunting skills. Buzzards or eagles, perch-hunting in open country, have demonstrated their ability to detect a grasshopper at more than 100 m, a vole or a lizard at 400 m and a rabbit at least at 1000 m.

Unsuccessful attempts often outnumber successful attacks even by experienced adults, except for birds preying on insects and small rodents. The success rates of attacks on birds by sparrowhawks or harriers usually range between 10% and 50%. On average, young birds show a success rate lower than that of adults, and this rate steadily improves with age and experience.

Killing of prey is achieved mostly using the feet and talons, but large vertebrates are ultimately killed by pecks at the head and neck, while the claws may stab vital organs. The non-



comestible parts of prey, such as large bones, or the legs and wings of birds and insects, are often discarded. Birds are plucked carefully. Curiously, many species first eat the head of any vertebrate caught, especially if the rest of the animal is brought to the nest. The intestines are frequently removed, and the head of a snake will be crushed or ripped off before the body is swallowed whole, at any rate by snake-eagles.

Small prey items up to the size of rats are either swallowed whole or torn to pieces, using the bill. Undigested remains gather to form a pellet of fur, feathers or chitinous pieces of insects that is regurgitated through the mouth. Small raptors cast one or two pellets daily, but larger species may produce less than one per day. Prey is often brought to the nest already partially prepared or eaten, for instance plucked and decapitated birds, or headless mammals. The *Gyps* vultures feed their young with regurgitated, partly digested meat, which is mixed with saliva presumably containing the necessary digestive enzymes.

The diets of unspecialized species vary between seasons, according to prey availability. Young, more inexperienced birds often take smaller or more easily caught prey, either because they still lack the skill of adults, or because they are kept away from the best food sources by the territorial or socially dominant behaviour of adults. Immature African Fish-eagles often eat carrion, whereas adults depend almost entirely on fish. The females of Eurasian Sparrowhawks and Northern Goshawks on average take larger prey than those taken by the smaller males.

The daily food requirements of members of the Accipitridae vary from about 25% of the bird's body weight in small active species during winter in temperate areas, to 10-15% in medium-sized buzzards of 700-1200 g, to less than 5% for large eagles in captivity. Mean consumption is at least 20-30% higher in winter than in summer, and it decreases by about 50% from temperate to tropical species of similar sizes and

diets. In Scotland, the total annual food requirement of a pair of Golden Eagles and their young was estimated, including wastage, at 457 kg, which worked out at about 10-20% of the food available on their home range. The total food consumption of a brood of Eurasian Sparrowhawks during the 32 days of the nestling period works out at 6-13 kg, with about 10 passerine birds per day brought to the nest by the male, to feed the female and the young. In turn, adult Hen Harriers (*Circus cyaneus*) have been calculated to bring in an average of 3.2 voles per nestling per day. At the other extreme, the Harpy Eagle, in the South American rain forests, delivers only one prey item per week to the incubating female, and one item every 3-5 days to its young. The equivalent rates recorded for the Crowned Hawk-eagle in Kenya are respectively one item every 3-5 and 1-6 days. Caching of excess food has occasionally been recorded for several species, but it is much rarer than in falcons (see page 229). When food is abundant, excess quantities of prey are often brought to the nest, where they remain uneaten.

The prey selected is generally the most abundant, the most accessible and the easiest to catch. As is habitual amongst other predators, there is a strong tendency for the birds to take young, sick, odd-looking animals, or those that exhibit abnormal foraging, defence or escape behaviour. There is a fair amount of evidence to indicate that raptors can limit or reduce their prey's numbers locally. This has been demonstrated for Eurasian Sparrowhawks with respect to Great Tits (*Parus major*) and Blue Tits (*Parus caeruleus*) around sparrowhawk nests in English woods, and also in several cases for Northern Goshawks, on drumming male Ruffed Grouse (*Bonasa umbellus*) in North American forests, on corvids in Germany, and on introduced pheasants in Sweden over the winter. More generally, predation pressure is now known to have a long-term influence on the evolution of behaviour, habitat selection, life history and population dynamics of prey species. There is even conclusive evidence that specialized predators, such as the Rough-legged Buzzard, may be responsible for the marked 3-4 year cycle of lemming abundance in the Arctic tundra.

Breeding

One of the basic conditions for the reproduction of many raptors is the existence of breeding territories or exclusive hunting ranges. These are necessary in order to provide a steady source of food throughout the breeding season (see Habitat, General Habits).

Mutually exclusive defended home ranges tend to be the rule, but in some species birds may defend only a portion of their range. At the lowest extreme, scavengers, like vultures and Black Kites, and aerial insectivores, like the two Swallow-tailed Kites and the Mississippi Kite, often have a defended territory that is restricted to the immediate vicinity of the nest-site, while the birds overlap broadly in their hunting ranges.

Territorial behaviour is a fundamental spacing system that limits breeding densities of raptors. Territorial defence is maximum near the nest during the breeding season, and reaches a peak during the nestling stage. Direct physical confrontations between territory owners and intruders are rare. Usually the owner advertises its presence and ownership with a display flight. This warning system informs the neighbours of the continuous occupancy of the territory, and usually prevents them from crossing its boundaries. To repel a persistent intruder, many species, from sparrowhawks to eagles, have a clearly recognizable threatening display flight. It may be the slow, jerky, flapping flight of some sparrowhawks, goshawks and harriers, or the determined gliding approach, with the head fully stretched out in front, of the Short-toed Snake-eagle (*Circus gallicus*). Some species are very aggressive towards potential predators near the nest, and they may actually strike an intruder, even a human; species known to react thus include the Northern Goshawk, some harriers, the Roadside Hawk (*Buteo magnirostris*), the Harpy Eagle and the Crowned Hawk-eagle. In northern Mexico, Swainson's Hawks are frequently not dis-

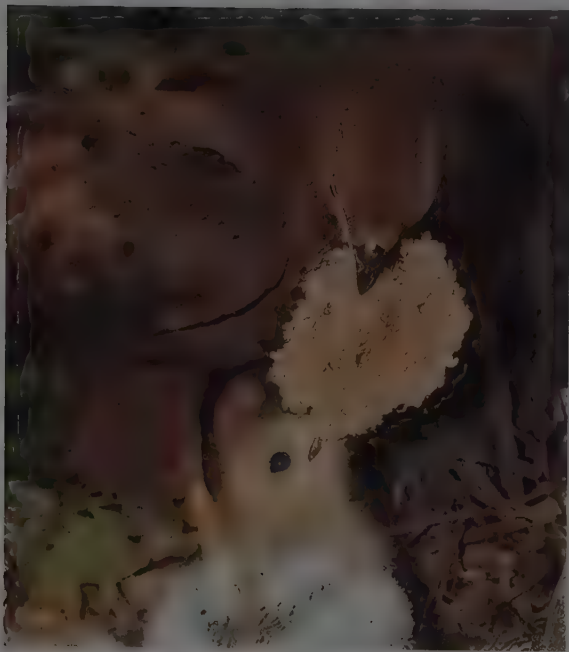
The Crested Serpent-eagle is the most widespread of the six members of the Oriental snake-eating genus Spilornis. It tends to take up position on a commanding perch in the forest edge, for instance along a stream or in a clearing, and here it keeps a sharp look-out. Once prey is spotted, the eagle stoops and attempts to capture it. Prey may be attacked on the ground or in trees, and indeed arboreal snakes, like this cat snake (Boiga), are frequently taken.

[*Spilornis cheela*, India. Photo: Belinda Wright/DRK]



The largest eagles are capable of killing mammals weighing well in excess of their own body weight, although such prey can not be carried away whole. In areas of rain forest the Crowned Hawk-eagle preys mainly on monkeys, tree hyraxes (Dendrohyrax) and small antelopes, such as suni (Nesotragus moschatus), but in drier parts of its range rock hyraxes (Procavia, Heterohyrax) and viverrids predominate. Most prey is taken on the ground, the eagle dropping rapidly to deliver a sharp blow with its feet. On occasions a monkey can even be knocked off a branch, to fall to its death. Monkeys are normally eaten whole, bones, teeth and all, and in the end only the fur remains undigested. This magnificent adult is feeding on a vervet monkey (Cercopithecus aethiops).

[*Stephanoaetus coronatus*,
Entumeni, Natal,
South Africa.
Photo: J. J. Brooks/Aquila]



suaded from violently striking an approaching observer, even if the human turns to face the attacker and waves his arms. Such behaviour is an efficient adaptation designed to minimize predation pressure. At close range, threat displays may involve raising the crest or the head feathers, stretching the head forwards or upwards, or opening the wings; very often the bird calls simultaneously. From an early stage, nestlings exhibit varying forms of defence behaviour against predators. Either they squat down and remain motionless to escape detection, or they lie on their backs and strike upwards with their talons, if

approached too closely. Male-female or parent-young relationships at the nest involve a variety of greeting, solicitation and begging postures or vocalizations that are critical for the maintenance of the bonds uniting the pair or the family.

In spite of the territorial behaviour of resident adults, a substantial floating population of immature or non-breeding birds remains within or between occupied territories. The presence of these surplus, non-territorial birds is difficult to detect, but it is suggested by the classic observations of the rapid replacement of lost mates that occurred when gamekeepers used to shoot females at nests. Such rematings occurred quickly, sometimes within a single day, and up to 3-6 times in succession within the same breeding season. This phenomenon was recorded in apparently healthy populations of Golden Eagles, Eurasian Buzzards and Eurasian Sparrowhawks in different parts of Europe. Even both birds of a pair were replaced sometimes, and an incoming female could take care of the brood left by the previous female. This is, therefore, further evidence that the number of pairs actually breeding may be strongly regulated by their territorial behaviour.

The mean specific densities of breeding raptors in suitable continuous natural habitat range from a minimum of 1 pair/100-300 km² for large eagles, down to 1 pair/1-2 km² for sparrowhawks. Most population studies carried out in Europe and North America over continuous areas of 30-150 km² have given a maximum total of 5-20 pairs of 4-8 accipitrid species per 10 km². Within smaller, more local patches of very rich habitat, densities may be higher, but in most cases and over areas larger than 100 km² the overall densities, with all species pooled, usually reach at most 2-5 pairs/10 km². The highest density ever recorded was in a mosaic of wooded savanna and gallery forest in Ivory Coast, where, within a study area of 27 km², the mean density was 48 pairs of 10 species of Accipitridae actually breeding per 10 km². At the same time, they co-existed with six additional species of non-breeding migrants, which in turn had a mean density of 35 individuals/10 km².

The Western Honey-buzzard is amongst the most specialized of the many insectivorous raptors. It is particularly keen on wasps and hornets, often digging out their combs and then picking out larvae, pupae and also adults one by one. The forehead, lores and legs of these birds are well protected against stings.

[*Pernis apivorus*.
Photo: A. Limbrunner]



*Amongst the most specialized feeders of all accipitrids are the three snail-eating kites, all of which have markedly hooked bills. The Snail Kite and the Slender-billed Kite (*Rostrhamus sociabilis*) both eat mostly apple snails of the genus *Pomacea*, which are regularly found in wetlands. These kites normally hunt from prominent perches, dropping down to snatch up prey with the feet. When flying off to a communal roost in the evening, a bird can often be seen carrying a snail in its bill.*

[*Rostrhamus sociabilis*,
Pantanal, Brazil.
Photo: Günter Ziesler]

African White-backed Vultures and Rüppell's Griffons are frequently to be seen together at the same carcass. These species mainly eat the soft muscle and organ tissues, whereas the larger, more solitary species will also consume the harder parts, including skin, sinews and bones. Birds will often thrust their heads and necks deep into a carcass, or will even climb right inside the rib-cage. The bare skin on a vulture's head and neck means it can feed without getting its feathers all clogged up with blood; indeed, feathering on these areas would actually be a liability for vultures.

[*Gyps africanus*,
Gyps rueppellii.

Photo: Ian Beames/Ardea]



Breeding density is inversely proportional to mean home range size, and it decreases markedly with increasing body size, though there are often substantial unused, or little used, areas between the regular home ranges of a given species. Densities are highest in scavenging or insectivorous species, intermediate for predators of small vertebrates, and lowest for the specialist predators of larger birds and mammals. The most spectacular concentrations of resident raptors, besides the colonial species, were found, at least formerly, in large towns in West Africa, the Middle East and India, where vultures and Black Kites took advantage of abundant food supplies. In Dakar, Senegal, and New Delhi, India, as many as 170-200 breeding pairs/10 km² of such scavengers were counted.

Habitat quality, nest-site availability and intensity of territorial behaviour are all important proximate factors that control breeding densities, but the abundance of the food supply is by far the most universal and limiting ultimate determinant. There is strong evidence that breeding populations are regulated by prey availability. Spectacular interannual fluctuations in the density of specialist predators of small rodents are directly correlated with rodent densities, whether it be Rough-legged Buzzards on the northern tundra, Hen Harriers on Scottish moorland, Montagu's Harriers on French agricultural land, or Common Black-shouldered Kites (*Elanus caeruleus*) in African ricefields.

Territory size and intensity of defence are lowered, while clutch size and breeding success increase markedly with an improved food supply. Such positive relationships, involving both numerical and functional responses to the main prey species' increase, have been found in almost all of the less specialized and more sedentary species studied, from small sparrowhawks to large eagles. It has been demonstrated that the nesting density of the Golden Eagle in Scotland was correlated with the amount of food, mainly carrion, available in winter, whereas breeding success was related to the amount of live prey available in summer, essentially in the form of grouse, hares and rabbits. A shortage of nest-sites may also limit the

density of a species below the carrying capacity of the habitat, for instance in cliff-breeding species.

Monogamy is the predominant mating system among birds of prey. Cases of bigamy are occasionally reported in some species or particular populations, for example in the Eurasian Buzzard in Scotland (not elsewhere), but these are always exceptions. To date, polygyny is only known to be regular in the Western Marsh-harrier, the Hen Harrier and Montagu's Harrier. In these species, the alpha female is fed more frequently by the male than are the other one or two females, so only the male appears to benefit from this mating system. Polyandry, where one female mates with more than one male and males also feed and defend the brood, is best known in the Galapagos Hawk (*Buteo galapagoensis*), and it has also been reported for the Black-breasted Buzzard (*Hamirostra melanosternon*). It also occurs in Harris's Hawk, where it may be more a case of a co-operative group, with one to five adult or juvenile helpers at the nest. Such groups have a linear hierarchy, and the subordinate birds rarely participate in activities at the nest, limiting themselves to bringing food and helping to defend the nest area. Alpha birds are the breeding pair, beta birds do not seem to be related to them, and gamma birds are probably young from a previous breeding attempt by that same group. It is perhaps surprising that there is no increase in the fledging success of this species for groups as against pairs, but one of the advantages may be that young birds have a longer period in which to learn hunting techniques. Another unusual case is that of the Snail Kite, which may be one of the few vertebrates to practise both serial polygyny and polyandry. In the Everglades of Florida (USA), during periods of food abundance, one bird of a pair frequently deserts a nest 3-5 weeks before the end of the normal period of parental care, leaving its mate to raise the brood to fledging. Females tend to desert small and medium-sized broods, while males leave large ones, and the deserter may go off to renege with a new mate. The remaining parent rarely deserts, and, in fact, has a high chance of rearing the young successfully, as



The eight fish-eagles of the genus *Haliaeetus* are mainly fish-eaters. They also take significant quantities of carrion, although this too is often in the form of fish. Like other piscivorous members of the Accipitridae, they tend to locate their prey mainly from perches, rather than during foraging flights, which are more likely to turn up carrion. In this respect they differ from the Osprey (*Pandion haliaetus*), which typically hovers over the water and then plunges right in. In contrast, having spotted a fish from a perch, the far bulkier, less agile fish-eagles fly over and pounce on the fish in a moment when it is very near the surface, normally immersing only their feet and legs.

[Above: *Haliaeetus leucogaster*, Gal Oya National Park, Sri Lanka. Photo: Dieter & Mary Pläge/Bruce Coleman.]



Below: *Haliaeetus leucocephalus*. Photo: Mark Newman/FLPA]

75% of the reproductive effort has usually been expended by the time of desertion. However, despite these notable exceptions, most species typically remain mated for life, and even in migratory species birds tend to come back to the same breeding site, and the pair may even migrate together, although there is little, if any, hard evidence for this.

Truly colonial breeding occurs in Rüppell's, the Eurasian and the Cape Griffons. Concentrations of up to 1000 nests are known along the Got escarpment in Tanzania and the Hombori

cliffs in Mali. Several other species may breed in colonies, where food is abundant or breeding sites localized, but they are not obligate colonial breeders, and they are commonly found in scattered pairs. For instance, more than 30 pairs of Montagu's Harriers can nest within a few hectares, whereas over 100 pairs of Black Kites may nest together; other typical examples include the Mississippi Kite and the Snail Kite. Opportunistic concentrations of nests often occur in several species, in areas where there is suitable nesting habitat within rich foraging



Once caught, a fish is carried to dry land or some other convenient perch and consumed.

The heavily built fish-eagles have no difficulty in catching or dealing with sizeable fish, and the very strong bill can quickly tear the fish apart. Fish-eagles are actually quite versatile and will sometimes fish in a style similar to that of the Osprey. Again, they will forage by wading in shallow water, particularly where there are concentrations of dead or dying fish. They are also prone to launch kleptoparasitic attacks on other birds, when their sheer size offers them a good chance of success.

[Above: *Haliaeetus vocifer*,
Okavango, Botswana.
Photo: Dieter & Mary
Plage/Bruce Coleman.



Below: *Haliaeetus albicilla*,
Volga Delta, Russia.
Photo: Tony Bomford/
Survival]

grounds, for example isolated cliffs, woodland or canyons, but these are not considered as true colonies.

Breeding first occurs at the age of 1-2 years in small *Accipiter* hawks and harriers, 2-3 years in buzzards and large kites, 4-5 years in eagles, including sea-eagles, 5 years in griffon vultures (*Gyps*), and up to 6-9 years in the largest vultures and tropical forest eagles. In many cases, the age of maturity is inferred from the age at which adult plumage is acquired or the data come from captive birds, but in the wild individuals

of many species have been seen to reproduce successfully in subadult or even in immature plumage, 1-2 years before the full adult plumage is actually assumed. This tendency is more common in undersaturated populations, which is not perhaps surprising, as it has been shown that when density is high a significant proportion of seemingly mature birds do not breed. Therefore, the mean age of first breeding may be significantly greater than the potential age set by physiology, and it is probably delayed by behavioural factors.



Verreaux's Eagle is a highly specialized hunter, and at least 90% of its diet normally consists of rock hyraxes (*Procavia*, *Heterohyrax*). One of its main techniques consists of flying very low round sunning hyraxes, giving them no time to escape

[*Aquila verreauxii*,
Serengeti, Tanzania.
Photos: Joan & Alan
Root/Survival]

All species of the Accipitridae build a nest, which is often a solid structure of sticks, with finer material inside the cup. Eagles, as well as large buzzards, kites and vultures reuse old nests year after year, sometimes for several decades, when other sites are scarce or the nest-site is safe. In such cases, the construction may reach enormous proportions. One famous Bald Eagle eyrie was three metres wide and five metres deep. Smaller species build much smaller platforms, and they usually build a new one every year. The *Gyps* vultures, serpent-eagles and snake-eagles build relatively small nests, considering that they are all large birds, and several of them often make a new nest each year.

There is a great deal of variety in terms of nest-sites, and each species has its own preferences as to position, height, orientation, shelter, accessibility and visibility. The nests of most species are in the upper parts of trees. Cliff ledges or caves are almost invariably used by six species of vultures. Seven buzzards, two eagles and the Black-chested Buzzard-eagle (*Geranoetus melanoleucus*) also predominantly use cliffs or low rocks. Only the Steppe Eagle and the harriers nest almost always on the ground, although the Spotted Harrier (*Circus assimilis*) is a tree-nester. Some cliff-nesters, such as the Golden Eagle, build on trees occasionally, and they may even do so regularly in some areas. In turn, several tree-nesters use cliffs, or at least small trees on cliff ledges when they are available. A few species even nest on the ground on predator-free islands, for instance the Eurasian Buzzard in Scotland and the Bald Eagle in the Aleutians, and an increasing number use man-made structures, notably several kites, buzzards and eagles on pylons, or the Black Kite on buildings. There is a fair amount of evidence to indicate that some nesting sites are superior to others, and such sites are repeatedly occupied, even though the owners may change. When Eurasian Griffons were reintroduced to central France more than 40 years after their extinction, they first reoccupied the very same nest-sites that had been used by the last wild pairs.

Many species use old nests, to which they add new material. Changes in nest ownership are commonly observed at the onset of a new breeding season amongst buzzards, kites, goshawks and even eagles, and this strategy can save a good deal of time and energy at the beginning of the season. Resident eagles, buzzards or goshawks often have several nests in their territories and use them alternatively from one year to another. They may refurbish more than one each year, or use alternative sites for roosting, or for preparing prey items for delivery. Whether or not a nest-site is changed from one year to the next is strongly related to the breeding success of the previous year; safety reasons are probably a significant factor affecting this, although it might also be a mechanism to avoid an excessive build-up of parasites. This habit of alternating nest-sites is

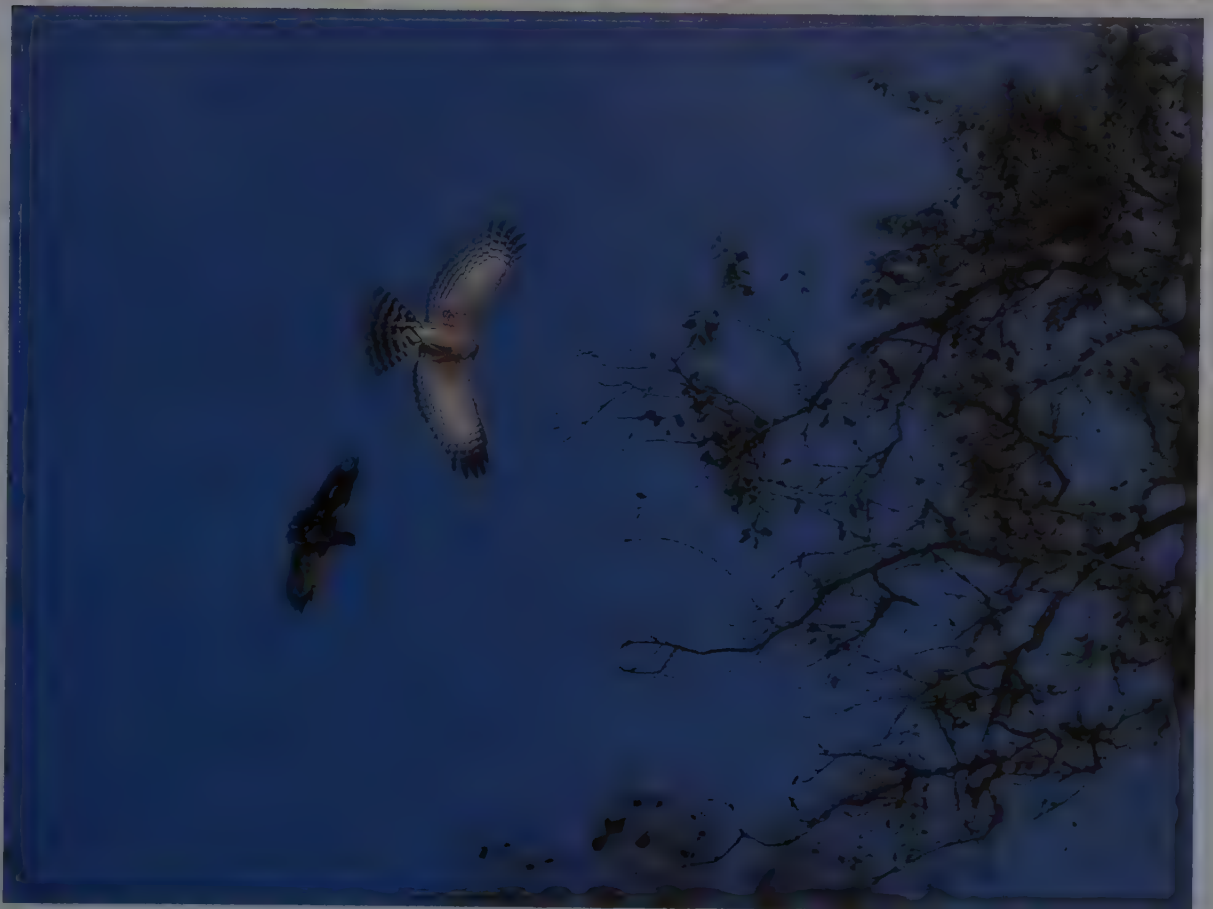
found amongst temperate species more commonly than amongst tropical ones.

Twigs with dead leaves or grass are often added to the stick structure, as is wool in the nest of the Bearded Vulture. Black and Red Kites incorporate a mass of rags, paper, dung and other refuse, as, to a lesser extent, do the Egyptian and Hooded Vultures. Several species have the characteristic habit of bringing fresh green vegetation, mostly leafy twigs, to the nest throughout the breeding cycle, especially in the early stages. The purpose of this has been the object of many hypotheses, but there is still no satisfactory and widely accepted explanation for this behaviour; it is not performed by species with small, concealed nests.

The female often seems to select the nest-site and usually does most of the construction, but the male may bring much of the material to her. The duration of nest building varies from 1-2 weeks in small kites and sparrowhawks, or late migrants, such as the Western Honey-buzzard, up to several months in large eagles, when they have to build a totally new nest. Nest construction, as well as other pre-laying activities, tends to be longer in tropical countries than in temperate latitudes, where the duration of the breeding cycle is more constrained. It is shortest at the highest latitudes. Some of the material added to the nest may help to camouflage it, for instance the dead leaves used by honey-buzzards, or sticks festooned with the webs of social spiders brought in by the Dark Chanting-goshawk (*Melierax metabates*).

Apart from such camouflaging, there are many other forms of behaviour that are probably related to anti-predator defence. The nest is always guarded by the female, and she remains on it or close by. While incubating, especially when hatching is near, she squats low, freezing on the nest at the approach of a human intruder, and flying off unobtrusively at the last moment. Once off the nest, she makes loud alarm cries, or attacks the intruder to drive him away. Fledglings tend to move away from the nest as soon as they are able to, coming back to it at night or to be fed by their parents.

In temperate regions, the breeding season is in spring and is related to mild temperatures and maximum food supplies. The laying date is thought to be adapted to the necessary length of the breeding cycle and the growth rate of the young, and ultimately to permit the fledging period to coincide with the optimum availability of the preferred prey. Thus, the Eurasian Griffon and the Bearded Vulture begin to display and even to lay in mid-winter, whereas the Eurasian Sparrowhawk does not do so until late spring. As one moves northwards within the temperate zone, the species start their breeding attempts later on, and they tend to have shorter breeding periods, showing a higher degree of intraspecific synchrony. Laying is also significantly earlier when prey density is higher, after a mild winter



The goshawks and sparrowhawks of the genus *Accipiter* rely mainly on surprise to capture their prey, which normally consists of a mixture of small birds and mammals, amphibians, lizards and the like. The hawk regularly lies in ambush, dashing out with a sudden burst of acceleration, and often, if necessary, with a few dexterous manoeuvres. Once the element of surprise has been lost, only a rather brief chase is likely to ensue before the hawk gives up; its broad, rounded wings are not well suited to the more lengthy pursuits performed by falcons. This African Goshawk has failed in its attempt to catch a Rüppell's Parrot (*Poicephalus rueppellii*), a species probably capable of much faster flight than the goshawk over any but the shortest of distances.

[*Accipiter tachiro*,
Etosha, Namibia.
Photos: Günter Ziesler]



Reptiles constitute a major source of food for a number of species. In different habitats, the Martial Eagle specializes on medium-sized mammals or large birds, but in some areas monitor lizards are its main prey. This large, powerful eagle spends long periods soaring aloft on the look-out for suitable prey. Once this has been located, the eagle embarks on a long, steady, usually rather shallow dive, lunging in on its victim on the ground, and braking sharply with its wings and tail spread.

[*Polemaetus bellicosus*, Kruger National Park, South Africa.
Photo: J. MacKinnon/
Planet Earth]

and early spring, and in older, more experienced adults. These same factors of food supply, weather conditions and experience seem to act through the body condition of the female, and they subsequently influence clutch size and, in the end, breeding success, through the female's care of the eggs and young and the amount and quality of the food provided by the male.

In tropical areas, where the seasons are based on the rainfall regime, raptors tend to breed during the dry season. The large species begin early in the dry season, the smaller ones in the second half, both timed in order that the young may fledge early in the wet season, when there is a plentiful flush of new food, but before the vegetation cover reaches its full development, and also before the rains become too troublesome. Near the equator, with two marked wet seasons, raptors breed during the longer of the dry seasons or during both, as is known to be the case of the Gabar Goshawk, where marked birds have been found breeding twice a year. In more aseasonal or unpredictable environments, some species may lay eggs in almost every month, for example the Galapagos Hawk. In arid central Australia, the nomadic Letter-winged Kite may breed at any time, following the irregular rains that constitute the major determinant of rodent outbreaks.

In partial migrants, the male either arrives first or remains on the territory. In some other migrants, such as *Accipiter* hawks, the female more often returns first, whereas in at least a few late arriving migrants, the two sexes appear simultaneously, as if they were already paired. Pair formation and copulation are mostly performed at the nest-site or in the immediate vicinity. Copulation sometimes occurs several hundred times during the pre-laying period, for instance in the Northern Goshawk, often following aerial displays, nest building bouts or courtship feeding. The female stays at the nest throughout the pre-laying period, when the food brought by the male is crucial

for the number and quality of the eggs that are to be produced. The female invites the male to mate using particular attitudes, such as bowing the head, dropping the wings, crouching, or showing off the conspicuous uppertail- or undertail-coverts.

Besides intensive nest defence against intruders, mate guarding and regular courtship feeding, the male also performs spectacular display flights, to reaffirm his ownership of the territory, to attract a mate or to strengthen a pair-bond. Eagles, including some snake-eagles, and also some harriers and buzzards, perform undulating "pendulum" flights, diving with the wings closed, then rising with the wings spread, swinging round and over, and retracing the course repeatedly; cuckoo-hawks and bazas (*Aviceda*) sometimes even roll and loop, or tumble about. The birds may remain silent, but for some, such as the hawk-eagles, loud calls are a prominent part of the display. In mutual displays, the two sexes can cross their flight-paths, or the male descends towards the female with his wings raised, and the female turns over and presents her claws, as occurs in several buteos and the Black-chested Buzzard-eagle. In Eurasian Griffons, mates glide very close to each other, their wings fully stretched. Other notable displays include those of honey-buzzards, which have characteristic wingbeats that involve clapping over the back, while the Crested Goshawk (*Accipiter trivirgatus*) and the Grey-headed Kite (*Leptodon cayanensis*) have rapid, fluttering, downward wingbeats. Simple soaring and calling are common in many raptors, as are temporary groupings of several birds calling together. The simplest form, used by small or non-soaring tropical forest raptors, is an advertising posture in which the bird perches on a prominent tree top. The loud calls of perched or flying African Fish-eagles are particularly striking and well known.

The eggs have a rather rounded oval shape, and are mainly white in ground colour, often with a blue or green tinge, and

The tarsi of the African Harrier-hawk can bend 70° backwards and 30° sideways; its head is small and narrow. These peculiar adaptations are connected with its habit of foraging in cracks or holes on vertical tree trunks or amongst palm fronds. It also specializes in taking nestling chicks from weaver colonies, clinging onto a nest or a branch and tearing open the nests.

[*Polyboroides typus*.
Photo: M. C. Wilkes/
Aquila]



often marked with brown, reddish or grey. The inside of the shell is greenish or pale bluish. Most large species of eagles and vultures, as well as tropical species of any size, especially in rain forests, lay 1-2 eggs. Small and medium-sized temperate species of kites or buzzards lay 3-4 eggs, whereas a normal clutch size of 5-6 is found in small accipiters and in harriers. Clutches of over six eggs are exceptional, and sometimes result from two females laying in the same nest. However, such large clutches are laid by rodent specialists, such as the Rough-legged Buzzard, Montagu's Harrier and the Common Black-shouldered Kite, at the peak of vole or lemming cycles, since their clutch size is greatly affected by food availability and may vary from no eggs, and consequently no breeding, in

poor years, to five or more, in years of rodent outbreaks. As with other birds, mean clutch size tends to increase with increasing latitude: it doubles in Eurasian Sparrowhawks between North Africa and Scandinavia, or in the Broad-winged Hawk between Caribbean islands and southern Canada. Eagles in temperate zones lay two eggs, or sometimes three, except the Short-toed Snake-eagle, which is a determinate single egg layer. Comparable species in the tropics lay only one or two eggs. The full clutch represents 4-8% of body weight in small species, to less than 3% in the largest species.

Eggs are laid at intervals of two days in small species, or three to five days in larger species. Since incubation begins with the first or second egg, the young of earlier eggs hatch quite some time before those of later eggs, and thus have a significant size advantage over them. This asynchronous hatching gives rise to intense sibling competition, and the youngest chicks often die of starvation or due to aggression by their nest mates. In some eagles, for instance the Lesser Spotted Eagle, the oldest chick always kills the smaller one, even when food is not in short supply. This so-called "Cain and Abel" conflict has been tentatively explained by several theories, but none of them is fully satisfactory.

The incubation period varies considerably between the different groups, lasting about: 28-38 days in harriers; 28-36 days in sparrowhawks; 35-38 days in larger goshawks; 28-38 days from the smallest to the largest buteos; 36-48 days in *Aquila* eagles; 47 days in the Short-toed Snake-eagle; 48-56 days in the largest tropical forest eagles; and up to 52-60 days in the largest vulture species. In accipiters and harriers, the female incubates alone. In larger species, however, from kites and buzzards to eagles, the male relieves the female for short periods, or sometimes, as in Verreaux's Eagle, shares a significant part of the incubation, a tendency more common with clutches of two eggs than of one; the male almost exclusively takes his turn during the daylight hours. The incubating female is fed by the male, but sometimes she also hunts for herself. In vultures, the sexes share the incubation duties more or less equally, and

Many accipitrids sometimes perform a "Mantling-display", spreading their wings over a prey item to create a sort of canopy. This behaviour is most commonly employed to guard the food from pilfering attacks by conspecifics or other species, and it may be accompanied by the puffing up of feathers and threat calls. The same display can be seen in well grown chicks on the nest, when warding off siblings from food that has been appropriated. This Northern Goshawk has killed a Common Moorhen (*Gallinula chloropus*).

[*Accipiter gentilis*.
Photo: J. Watkins/FLPA]





Like most of the buzzards or hawks of the genus *Buteo*, the Red-tailed Hawk is something of a generalist in terms of its feeding habits. Overall, it feeds mostly on small to medium-sized mammals, birds and reptiles, but in some areas snakes make up approximately 50% of all the prey taken (by biomass), and these can include venomous species, as illustrated here by an immature bird, which is in the process of killing a fairly large eastern diamondback rattlesnake (*Crotalus adamanteus*).

[*Buteo jamaicensis*.
Photo: L. Lee Rue/FLPA]

the female leaves the nest to do all her own feeding herself. During incubation, all species frequently turn the eggs and shift their position. Infertile eggs regularly occur in the clutches of most species, even in healthy and uncontaminated populations of both temperate and tropical countries. In Ivory Coast, Nigeria and Kenya, research showed that up to 20% of all eggs were infertile in two-egg clutches of eagles, Hooded Vultures, African Harrier-hawks, Lizard Buzzards and Black Kites.

The nestling period, from hatching to the young bird's first flight, again varies a great deal, especially with size, lasting: 24-30 days in small sparrowhawks; 29-46 days in harriers; 40-45 days in goshawks; 42-49 days in *Buteo*; 60-77 days in temperate eagles, such as the Golden Eagle, the Eastern Imperial Eagle and the Short-toed Snake-eagle; 95 days in another *Aquila* of the tropics, Verreaux's Eagle; 95-130 days in large vultures; and 105-148 days in the largest tropical forest eagles, notably the Harpy Eagle. The chick's first contour feathers appear during the second third of the nestling period as wing and tail quills. The body feathers quickly follow, first on the upperparts. The growth rate of chicks is spectacular, but it draws to a halt near fledging time, when the young bird may even start to lose weight, because of reduced feeding rates.

During the last third of the nestling period, the young bird ceases to require parental protection, and it becomes increasingly active, even starting to feed for itself. Prior to leaving the nest, it indulges in bouts of vigorous wing-flapping exercises. The first flight out of the nest is usually made without any parental coaxing, but, in some cases, it may be under the close surveillance of the adults, and in response to their forceful encouragement. After leaving the nest for the first time, young birds are often unable to make an upward flight back to the

nest, and they must be fed out of the nest for several days, until they are stronger on the wing, and able to come back to the nesting platform.

In dimorphic species, males grow faster than females, and in sparrowhawks and goshawks a male often spends 3-4 days less at the nest than a female, and this may be eight days less in the Crowned Hawk-eagle. This compensates for the smaller size of male chicks, and their resulting competitive disadvantage. Even in species where the Cain and Abel battle always eliminates the younger chick, there is no conclusive and generalized evidence of a significantly skewed sex ratio in fledglings. On the whole, the mortality rate during the nestling stage does not differ between the sexes. It is normally in the range of 20-40%. This mortality is mostly associated with food shortage, acting through the dominance of the elder members of the brood, which are strongest and which are always fed first, until they become satiated. This is an adaptive mechanism whereby breeding success is controlled by food availability.

Except in vultures, where the two sexes share the duties of brood care equally, the male does not normally feed the young, but only brings prey to the female, leaving it to her to dispense the food. However, if the female disappears, the male may sometimes be able to feed the young efficiently, at any rate if the chicks are already roughly half-grown. In the Snail Kite, one adult often deserts the nest at an early stage, in order to renege elsewhere, leaving its mate alone to care for the eggs and young, often successfully. In most species, the male provides almost all of the food for the female and chicks, from the pre-laying stage to about half way through the nesting period. The high rate of energy expenditure that this implies often induces weight loss in the male. Towards the end of the nestling period, the female hunts progressively more and more, so as to

help meet the increasing food requirements of the growing young.

Wing and tail quills continue to grow for some time after fledging, even up to 3-4 weeks more in kites and goshawks. At this stage, young birds tend to follow the adults about persistently, but they return to be fed at the nest, where prey is delivered at least for several days and for up to 2-4 weeks in eagles. They slowly begin to hunt for themselves, first trying to catch easy prey, such as insects, before turning to more difficult quarry. Their poor success is compensated for by the prey brought by their parents. Definite examples of actual training by adults have been reported more rarely and more inconclusively than in falcons. The development of hunting skills is very variable between individuals. In Europe and North America, young buzzards may still be fed 2-6 weeks after fledging, and they may stay in their parents' territory for one to several months more.

Usually the adults do not drive their offspring away from the territory until just before the beginning of the next breeding cycle, but in many cases the young birds leave the territory, even while they are still being offered food. The young of late breeding migrants, notably the honey-buzzards, must be able to leave the breeding area only 2-3 weeks after fledging. They may do so before or after the adults, but there are several records of whole family groups departing or migrating in close association. Otherwise the young often disperse at random in any direction, for instance in the Eurasian Buzzard. Young Bald Eagles in Florida, however, regularly migrate northwards up to southern Canada in late summer, before returning in winter. When the period of dependence is relatively short, mortality tends to be rather high, partly because young birds still require plenty of time to perfect their hunting skills. The evolutionary strategy of tropical forest eagles, which are K-selected (with low productivity, but a long average lifespan), involves lengthening the learning period, and thus reducing first year mortality to the minimum. In the Harpy Eagle and the Crowned Hawk-eagle, and also in the Martial Eagle of more open habitats, post-fledging dependency can last 11-12 months, which means that the adults can breed successfully only every second year.

Overall breeding success, measured in the mean number of birds raised to fledging per successful nest, ranges in temperate countries from 2-4 for accipiters and harriers, to 1.5-2.6 in buteos, 1.2-1.8 in kites and honey-buzzards, and 1.1-1.6 in eagles, except the Lesser Spotted Eagle and the Short-toed Snake-eagle which never raise more than one youngster to fledging. In a West African savanna, the productivity levels recorded were 0.66 young per nest for two large species, the Palm-nut Vulture and the African Harrier-hawk, and 0.9-1.3 for two medium-sized species, the Black Kite and the Lizard Buzzard, and also one small species, the Shikra (*Accipiter badius*). However, in many populations, the proportion of all territorial pairs that do not breed at all, or that fail to fledge any young, is usually 10-40%. Indeed, the actual mean productivity of large vultures, such as the Lappet-faced Vulture (*Torgos tracheliotus*) in Africa, or of the large tropical forest species, including the Great Philippine Eagle, the Harpy Eagle and the Crowned Hawk-eagle, is below 0.4 young fledged per pair per year.

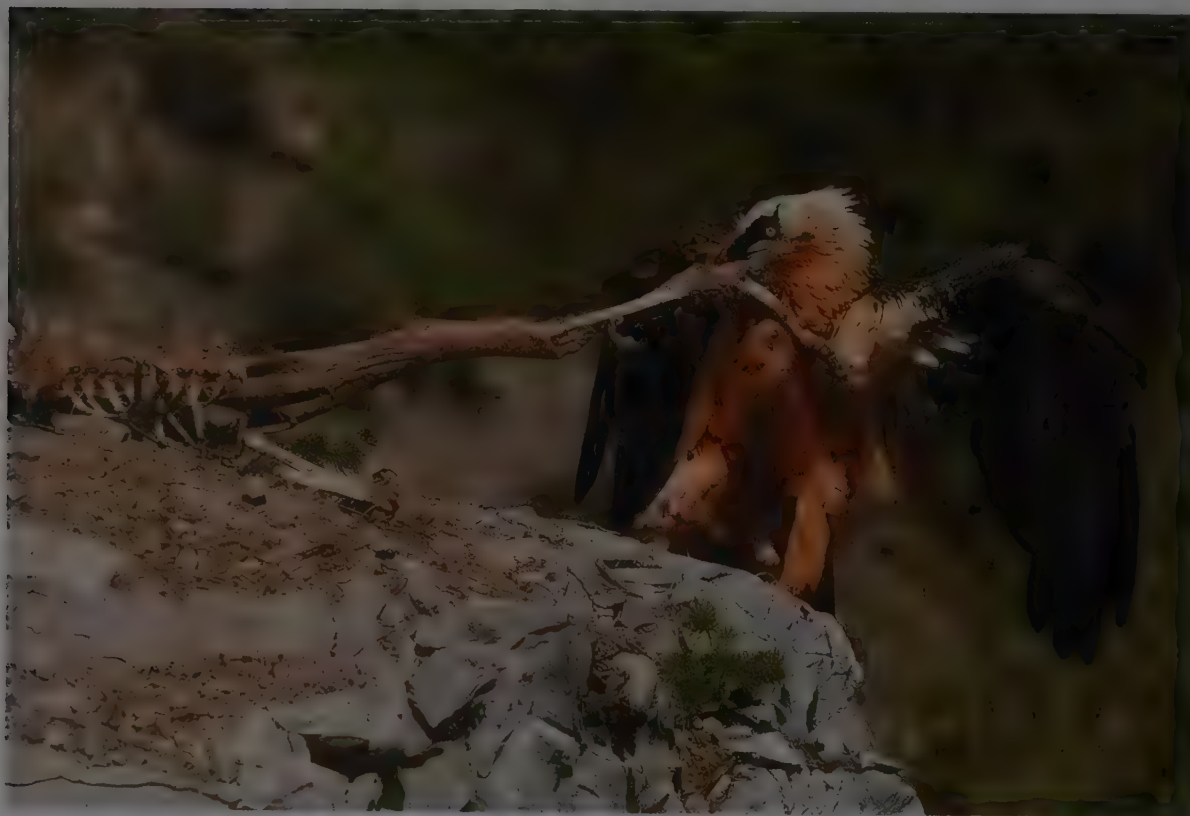
Whereas starvation and sibling competition are the major causes of brood reduction, nest predation is often a significant factor. Even formidable forest eagles, such as the Crowned Hawk-eagle in Africa, or Blyth's Hawk-eagle (*Spizaetus alboniger*) and the Mountain Hawk-eagle (*Spizaetus nipalensis*) in south-east Asia, often build their nests on surprisingly isolated trees, as if they were trying to avoid the attentions of monkeys or other dangerous nest predators. Chick mortality due to the effects of parasites, cold or rainy weather or excessive heat has been recorded in a fair number of species, but the overall significance of these factors is not well known. A seasonal decline in productivity, which is typical amongst many birds, has also been found in the Eurasian Sparrowhawk, the Eurasian Buzzard and the Bald Eagle, but it should be remembered that late breeding pairs are often younger or inferior breeders.

The overwhelming influence of food supply determines a species' breeding success at a whole series of different levels: the proportion of pairs actually breeding; the age of first breeding; clutch size and the quality of the eggs, and thus hatching success; the growth and survival rates of chicks and fledglings; and, finally, their subsequent dispersal patterns. Once again,

The mainly African genus *Circaetus* feeds heavily on reptiles, in particular snakes. Prey is mainly sought from a perch or by means of quartering flight, often interspersed with hovering. Once captured, snakes may be killed on the ground or in mid-air, depending on their size, and larger snakes have their heads crushed or severed prior to being swallowed. If necessary, the largest snakes are torn up, but birds are frequently seen flying back to the nest or to a suitable perch with the tail end of the snake still sticking out of the bill. This Short-toed Snake-eagle has caught a young ladder snake (*Elaphe scalaris*).

[*Circaetus gallicus*.
Photo: Rafael Delgado/
Nature & Travel]





Bones constitute up to 85% of the diet of the Bearded Vulture, in the form of both bone marrow and the bones themselves. Large leg bones are particularly favoured, and remarkably large bits of bone can be swallowed whole. However, when the bones are unmanageably big, either for swallowing or for crunching up, the bird resorts to a well known, but unique, solution. It takes to the air, carrying the bone, or even the whole skeleton, and rises up some 20-80 metres or more before dropping its load onto flattish rocks at a regularly used site, known as an ossuary. The bird quickly spirals down after the bones, in order to avoid losing them, and will repeat the process several times, if necessary, until the bones are sufficiently smashed for consumption.

[*Gypaetus barbatus barbatus*, Spain.
Photos: Francisco Márquez (above); Ramón Torres Valdivia (below)]

Apart from the large carrion-eating species, relatively few of the Accipitridae are known to drink, at any rate on any sort of a regular basis. Indeed, some species that are frequently kept in captivity have never been recorded drinking. The replenishment of body fluids to balance the losses sustained during excretion and pulmocutaneous evaporation is probably achieved mainly by the bird assimilating those of its prey.

[*Accipiter badius*
sphenurus, Gambia.
Photo: Mike McKavett/
Bruce Coleman]



this influence is most patently demonstrated, and also most marked, in birds specialized on cyclical rodents. From years when voles are scarce to those of pullulation, the Rough-legged Buzzards in Norway may fail to breed at all, or lay small clutches but not rear any young, or, at the other extreme, produce clutches of 4-7 eggs and rear 4-5 young to fledging. Golden Eagles and Ferruginous Hawks (*Buteo regalis*), in western North America, or Golden and Bonelli's Eagles from Scotland to Spain, are also very sensitive to the density of hares and rabbits. Breeding success rates vary widely with geographical area, latitude, habitat quality and altitude, but in all cases food seems to be a central factor.

Similarly, within a given region, different territories produce more or less young consistently over the years, as has been demonstrated for the Eurasian Sparrowhawk in Scotland. Cold wet springs affect breeding success through hunting time and efficiency, and the reduced presence of the female at the nest. In South Africa, heavy rains improve the productivity of Verreaux's Eagle, through an increase in its prey density. On the other hand, increased density of breeders affects their overall reproductive success due to the frequent interactions between territorial pairs, as shown in Verreaux's Eagle and the African Fish-eagle.

A very small proportion of species may exceptionally raise two broods in the same year. This has been documented in White-tailed Kite (*Elanus leucurus*) and the Common Black-shouldered Kite during periods of rodent pullulation. Social groups of Harris's Hawks, with the assistance of helpers, may also succeed in raising two successive broods, after good rains, in the semi-deserts of the south-western USA. Laying a replacement clutch, when the first one has been lost at an early stage, is not uncommon in small species, and is more regular when food is plentiful;

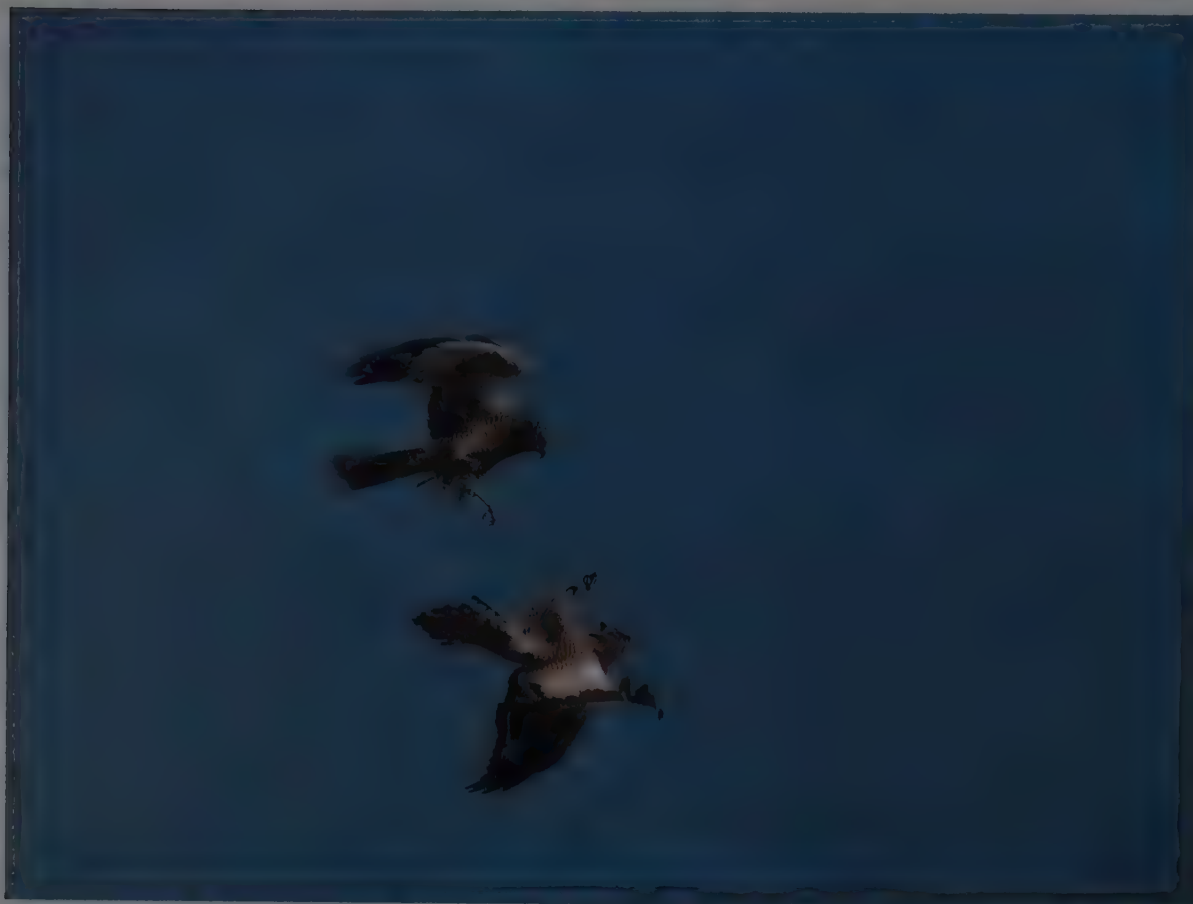
replacement clutches are normally laid about two weeks after the loss of the first clutch. Such replacement laying is less frequent in medium-sized species, and is rare or almost unknown in the wild in large species, although it can easily be induced in captive birds by the removal of the first eggs laid.

Mortality rates are well known for a few species only, and many estimates are biased, because recoveries of ringed birds are more frequent in densely populated areas, where human-related causes of death are prominent. The period of heaviest mortality is during the first months of a young bird's independence. Small species, such as the Eurasian Sparrowhawk, suffer 50-70% mortality during the first year, and 30-35% thereafter. This compares with a mean annual mortality of adults of about 20% in the Eurasian Buzzard, but only 2.5-5% in the much larger Golden Eagle and Eurasian Griffon. Overall mortality between fledging and the acquisition of adult plumage has been variously estimated at between 60-90%, and 79% of Eurasian Buzzards and 83% of Red-tailed Hawks are reckoned to perish within their first two years. Starvation, predation and, to a lesser extent, disease are the major causes of natural mortality, as also are accidents, in those species that are active hunters.

Documented longevity records in the wild are of over 15 years for Eurasian Sparrowhawks, and 24-26 years for Eurasian Buzzards and Red Kites in Europe. In captivity, several individual Golden Eagles, sea-eagles, Bateleurs and vultures have lived 48-60 years.

Movements

As an adaptation to seasonally fluctuating food supplies, many, perhaps most, species in temperate areas, and also in open



Many raptors perform spectacular aerial courtship displays. Amongst the most widely used and impressive is "Mutual Soaring", in which both sexes soar aloft together and the upper bird, usually the male, periodically dive bombs its partner, which rolls over and presents its talons. In some species the display is taken further, and the birds may actually grasp each other's talons; some species, including harriers, also perform a remarkable "Food-pass", the upper bird dropping or lowering a prey item into its partner's talons. During territorial defence, intruding conspecifics are occasionally repelled by means of similar, though more genuine, attacks, although a warning is usually enough to drive off most interlopers.

[*Circus cinereus*,
Torres del Paine National
Park, Chile.
Photo: Günter Ziesler]

habitats at tropical latitudes, perform seasonal movements of one kind or another.

The most typical kind of migration is the regular long distance shift of the whole population of a species between non-overlapping northern breeding grounds and tropical wintering areas, and this can be seen in many groups, for instance amongst Eurasian breeders; the honey-buzzards; the Black Kite; the Short-toed Snake-eagle; Pallid and Montagu's Harriers; the Levant Sparrowhawk (*Accipiter brevipes*), the Chinese Goshawk (*Accipiter soloensis*) and the Japanese Sparrowhawk (*Accipiter gularis*); the Steppe Buzzard, the race *vulpinus* of the Eurasian Buzzard; and the Lesser Spotted and Steppe Eagles. Examples of typical migrants from North America are the Mississippi Kite, and Swainson's and the Broad-winged Hawks. The migrations of such species involve hundreds of thousands of individuals moving at specific and relatively constant dates over considerable distances. The longest migrations include those of the Steppe Buzzard between Siberia and the southern tip of Africa, of the Western Honey-buzzard between Scandinavia and Central Africa, and of Swainson's Hawk between southern Alaska and northern Argentina, and each of these mounts up to a flight route of about 30,000 km per year. Most of these species are diet specialists and their food supplies are largely unavailable on their breeding grounds in winter.

More species are partial migrants with northern populations almost completely migratory and southern ones more sedentary. The Eurasian Sparrowhawk and Eurasian Buzzard are typical examples, as are the White-tailed Sea-eagle, the Bald Eagle, the Western Marsh-harrier and the Hen Harrier. These species migrate over shorter distances, the northernmost breeders going the farthest south, but even these individuals barely reach the northern tropics. Thus, in the Northern Hemisphere, the proportion of migrant species increases from south to north, and in Eurasia there is a similar gradient from the south-west to the north-east. Some northward movements of raptors breeding in southern South America have been recorded, but as yet they

remain poorly documented. The particular movements of partial migrants may actually change from one year to another, according to winter conditions. Immature birds are generally more migratory, and tend to disperse over longer distances and in higher proportion, than do the more sedentary adults.

Some populations or species remain within their breeding ranges while the food supply is still abundant, but move southwards in large numbers when it is scarce. These so-called invasions or periodical irruptions are typically performed by Northern Goshawks and Rough-legged Buzzards, because their prey, tetraonids and small rodents respectively, fluctuate cyclically. At middle or low latitudes, migrant populations often co-exist with the resident ones, and, in some cases, by the time they leave their winter quarters, the local residents are already breeding.

Immature birds first disperse in any direction whatsoever, in summer and early autumn, sometimes even moving northwards, as do young Bald Eagles from Florida, but even these birds resume a normal southward movement in late autumn. In species that do not breed until they are two or more years old, a substantial proportion of young birds remain on their wintering grounds or near them, at least during their first summer. This practice is common amongst young Western Honey-buzzards and Short-toed Snake-eagles, which stay on in Africa. Irregular, opportunistic or nomadic movements, involving breeding or non-breeding populations, occur in the rodent specialists, for instance the Rough-legged Buzzard of the Arctic tundra, and the Letter-winged Kite of Australian deserts, and also in the locust predators of the Sahel, such as the African Swallow-tailed Kite. Within their wintering ranges, several species wander about over large areas, concentrating at abundant food supplies. This is typical of gregarious insect-eaters, like Montagu's Harriers feeding on locust swarms in West Africa, Steppe Eagles tracking emerging termites in East Africa, or Swainson's Hawks catching insects in South American *pampas*.

Whereas there are no movements known among tropical rain forest raptors, many species in African savannas perform

Copulation normally takes place at the nest-site or very nearby, but not actually on the nest itself. It tends to be repeated a great many times even before the female is ready for fertilization, and probably serves as a form of courtship behaviour to strengthen the bond. It is typically preceded by courtship feeding, nest building or an aerial display, and the female will adopt certain standardized postures that invite the male to mate with her. The Galapagos Hawk is one of very few bird species found to operate an apparently stable polyandrous mating system, in which up to four or even eight males are associated with a single female.

[*Buteo galapagoensis*,
Fernandina Island,
Galapagos.
Photo: Günter Ziesler]



seasonal migrations. Within West Africa, five species perform erratic movements, thirteen are partial migrants, and six undertake regular, long distance migrations, at least of several hundred kilometres, along a north-south axis between the rain forest and the edge of the Sahara. In highly migratory species, there is little overlap between the ranges occupied during the rainy and dry seasons. The northward movements are closely related to the onset of the rains, and the southward return follows the beginning of the dry season. The birds invariably occupy the latitudinal range where food availability and accessibility best meet their requirements, in terms respectively of the abundance of locusts and small vertebrates, and the grass cover. Typical migratory species are the Black Kite in its race *parasitus*, the Shikra, the Grasshopper Buzzard (*Butastur rufipennis*) and the Red-necked Buzzard (*Buteo auguralis*). Similar movements are known to occur south of the equator, and two species are known to cross the equator during their annual movement, Wahlberg's Eagle (*Aquila wahlbergi*) and the Ovambo Sparrowhawk (*Accipiter ovampensis*). In Africa, as in tropical America and southern Asia, the temperate wintering migrants are ecologically segregated from their most similar counterparts. They tend to occupy secondary, marginal or seasonal habitats that are little used by residents of comparable niche, and they mainly exploit seasonally surplus food sources, such as swarms of locusts or termites, breeding colonies of queleas, bush fires or drying wetlands. Thus, there is little or no real competition between the migrant and resident species.

Broad-winged species migrate by soaring in updraughts created by wind, or in thermals, rising currents of warm air. They climb as high as possible, and then glide down, sometimes over a long distance, towards the next air current, where they can regain the lost height. They try, as far as possible, to avoid highly costly flapping flight and also sea crossings, as there are only weak thermals in special conditions over water. Consequently they tend to fly almost exclusively over land and in good weather conditions. They make frequent detours to search

for good updraughts, and they can go a long way round coasts or mountain ranges, to avoid the sea crossings or to use the lowest passes.

Such species are also strongly gregarious, and multispecies flocks of several hundred birds are not rare. This is a necessary adaptation as the birds need to share the best air currents available for energy saving. When they come together in a thermal, different birds will often leave it at different times and heights, depending on their specific and markedly different flight speeds and abilities. Highly gregarious species include hawks, kites and eagles, but also the smaller Levant Sparrowhawk in the Middle East, or the Grey-faced Buzzard (*Butastur indicus*) in the Far East. When conditions are favourable they can fly very high, and radar tracking and also migrant searching with powerful optical devices have shown that, in the midday heat, many of them may pass undetected, well above the range of visibility of the naked human eye. The highest altitudes recorded above ground level generally range from 2000 to 4000 m, with a maximum of 5000-6400 m for Broad-winged and Swainson's Hawks over Panama. More usual altitudes, however, are 200-1000 m above the ground. A Rüppell's Griffon, not a migrant, is said to have hit a plane at more than 10,000 m above sea-level, but this is probably an exceptional case.

The smaller species, mainly harriers, sparrowhawks and goshawks are more lightly built, and have a much more active style of flight. Although they are able to use thermals very efficiently, they are less dependent on soaring flight than the larger species, and they may use powerful flapping flight over long periods. This allows them to follow much broader migration routes, to fly during a longer period of daylight, to cross larger expanses of water more readily, and often to travel alone.

These different flight powers have important ecological and physiological consequences. Large soaring species of kites, buzzards, hawks, eagles and vultures, have constrained routes, on which over very long distances the habitat below may be unsuitable for stopping and feeding in, and especially to sustain the huge gatherings of birds that concentrate along such routes.



Very few birds of prey are colonial breeders, and the maintenance and defence of territories play important roles in spacing out the different pairs and also the non-breeders in any given population. Territorial defence is most intense around the nest itself, and is not surprisingly more vigorous during the breeding season. In most cases a mere threat display is sufficient to drive off an intruder, but some species regularly launch an attack against any potential predator that approaches the nest, and will deliver sharp blows with the feet, even against humans.

[*Buteo augur*.
Photo: Alan Weaving/
Ardea]

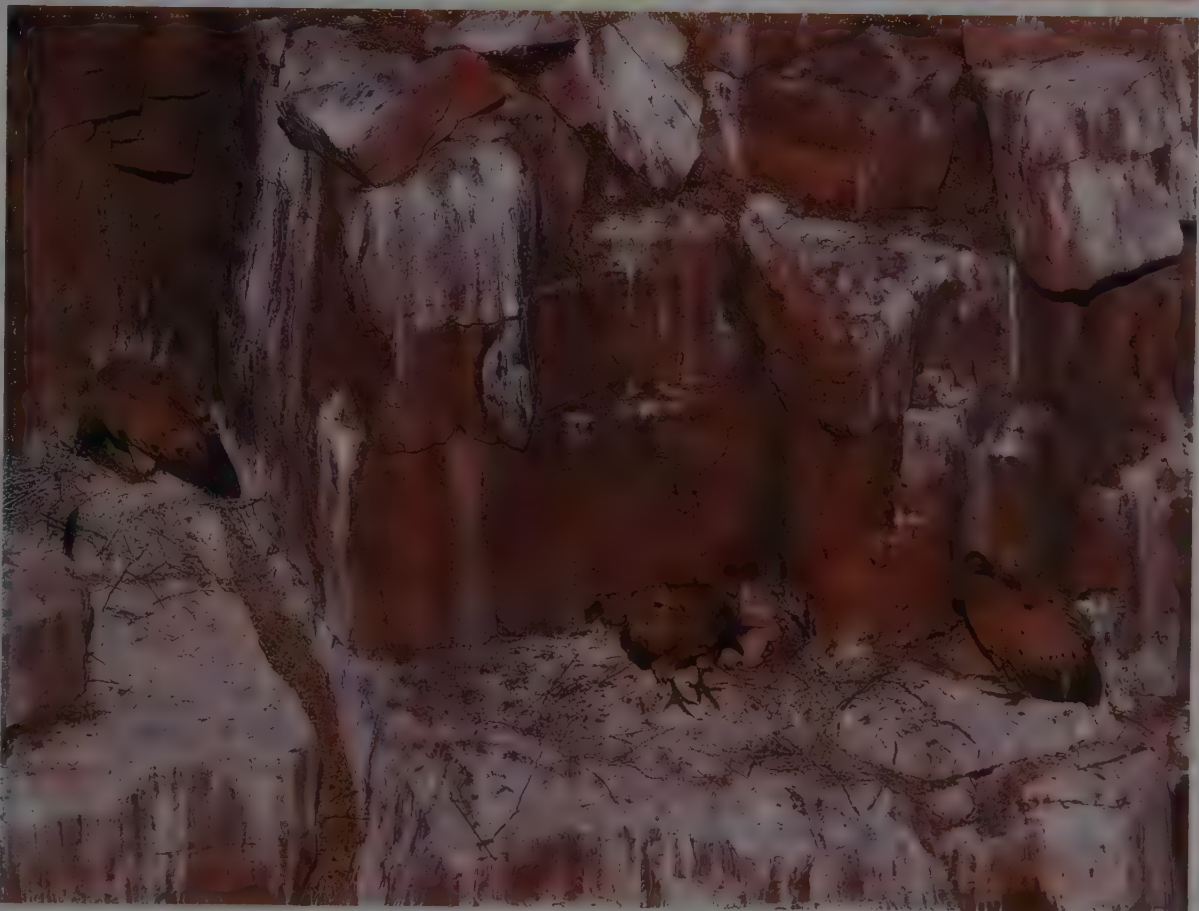
This is why at least several of these species have evolved some of the typical adaptations of long distance migrants, such as pre-migratory fattening. Their ability to cover a large part of their migration without feeding is now well documented, and it is commonplace to see huge concentrations of Western Honey-buzzards, or Swainson's or Broad-winged Hawks, stopping for the night; yet not one bird attempts to hunt or casts a pellet.

Even some smaller species, such as the Mississippi Kite and the Levant Sparrowhawk, also have the habits of using thermals extensively, travelling in large groups, and carrying out a speedy migration by covering long distances without interruption. In contrast, species that readily use flapping flight, such as harriers and many sparrowhawks, are better able to choose suitable habitats for stopping over in, sometimes for long periods, with the result that they can hunt almost every day. These species do not accumulate a substantial amount of body fat. The migration of Eurasian Sparrowhawks is often closely associated with the simultaneous movements of flocks of passerine birds, upon which they feed.

Almost all raptors travel only by day. Nevertheless, there is a fair amount of evidence that at least Montagu's and Pallid Harriers can migrate by night, with a series of observations from lighthouses, and the arrival of birds on sea coasts at dawn; recently, convincing data, gathered through radar tracking, have shown that Levant Sparrowhawks may do so regularly.

Where migration routes are channelled along mountain ridges, through narrow passes, and especially across straits at the narrowest sea crossings, the concentrations of migrants can be spectacular. These well known sites are used by teams of enthusiastic birdwatchers for counting the migrants, and thus following year after year the population levels. The most impressive sites are in Central America, where birds coming from the huge North American continent are funnelled into a narrow isthmus. In autumn, 2.6 million raptors have been counted over Panama, and recently in Veracruz, eastern Mexico, where the full flow of migrants has not yet become concentrated, 2.5 million were recorded, including 900,000 Broad-winged Hawks and 400,000 Swainson's Hawks, as well as one million Turkey Vultures.

Other famous concentrations of migrants occur along the south-west coast of the Black Sea and through the Bosphorus, and also around the eastern Black Sea coast in Turkey. These two fluxes join in Israel and go on through Suez, whereas more eastern populations follow the Red Sea coast along the Asir Mountains, to cross at the Bab al Mandab straits. Spring passage at Elat, at the head of the Gulf of Aqaba, the north-eastern branch of the Red Sea, has reached 1.2 million raptors of 28 species. The Mediterranean Sea is crossed at the narrowest straits, at Gibraltar and between Tunisia and Sicily, but numerous migrants also appear on Malta. Migration is studied at several concentration points in Europe, from Falsterbo in southern Sweden to the



Trees and cliffs provide nest-sites for the vast majority of species, although some nowadays use man-made structures, such as pylons and buildings, and a few even nest on flat ground, notably most of the harriers. The various different Old World vulture species tend to prefer one or other of these substrates, and only a few species will use either, depending sometimes on local availability. Tree-nesters, like the Lappet-faced Vulture, tend to be solitary, or at most loosely colonial. In contrast, cliff-nesters, like the Cape Griffon, habitually form sizeable colonies, sometimes holding around 1000 pairs.

[Above: *Torgos tracheliotus*, Masai Mara, Kenya. Photo: Günter Ziesler.

Below: *Gyps coprotheres*, Botswana. Photo: Clem Haagner/Ardea]



Unlike the falcons, all accipitrids build a nest, or at least refurbish an old nest. In the Common Black-shouldered Kite, material is mostly brought in by the male, while the female occupies herself more in the business of construction. Some material is collected from the ground, but often the male procures the necessary sticks from nearby trees, selecting and grasping hold of suitable twigs, and then snapping them off.

[*Elanus caeruleus caeruleus*, Nile Valley, Egypt. Photo: Oriol Alamany]

Alps and the Pyrenees, and likewise in North America, from the Great Lakes to Hawk Mountain. In Asia, similar localities are also well known, such as Beidaihe in China, the Korea Strait between Korea and Japan, the southern peninsula of Taiwan, and the Straits of Malacca at Cape Rachado, between Malaysia and Sumatra. To reach the Indian Subcontinent, raptors cross the Himalayas and the Hindu Kush at surprisingly high altitudes. In the upper Kali Gandaki Valley between Tibet and Nepal, many are seen well above 5000 m, and a Steppe Eagle has been found dead on Mount Everest, at over 8000 m.

Each species has its own seasonal and daily patterns of migration. For instance, in Europe, Black Kites are the first to leave, in August, and the first to come back, in March. In late summer, they are followed by honey-buzzards, which are the latest to come back, many of them not arriving until early June. Partial migrants are usually among the latest to depart in autumn, and the earliest to reappear in spring. There may be a certain segregation in time between different age classes. In Europe, for example, adult Black Kites and Steppe Buzzards leave about 3-4 weeks before the juveniles. The reverse is usually true in shorter distance migrants, and more adults are liable to stay put; this is the pattern in the Eurasian Sparrowhawk, the Eurasian Buzzard and the Northern Goshawk. Sometimes there is also segregation between adults and younger birds in the winter quarters, for instance in the Steppe and Lesser Spotted Eagles in East Africa. In the Western Marsh-harrier, the proportion of adult males present in winter decreases markedly with decreasing latitude.

Adult raptors usually show high fidelity to their breeding sites, and immature birds too demonstrate a strong tendency to settle in the same area, or to disperse over relatively short distances, often within less than 100 km from the natal area in most temperate species. Many incidental observations suggest that they may present similar fidelity to their wintering areas

year after year. This has been clearly demonstrated in marked adult Bald Eagles. The rate of return to the same territory or nest-site is positively correlated with previous breeding success, as is known for Eurasian Sparrowhawks, Eurasian Buzzards and Golden Eagles in Europe, and it may be equally associated with food conditions.

Relationship with Man

The attitude towards raptors of most, if not all, ancient civilizations and present day tribal populations throughout the world was, or still is, either neutral or rather positive. Only in modern societies has it been hostile.

In Ancient Egypt, a falcon was a god, and some hawks were also portrayed with religious significations; indeed, raptor representations abound on bas-reliefs in the temples and tombs of that civilization. Eagles and vultures figured prominently in the Aztec and Maya cultures, and both divinities and kings were represented with an eagle's head. Eagles were also present as emblems of power in old Chinese dynasties. Accounts and references to raptors are plentiful in the Bible, as well as in Greek mythology, and countless citations in the literature of the last centuries serve as reminders both of the old traditions themselves and also of the persistence of these old beliefs in the religious or cultural significance of raptors. Eagles were the emblems of the Roman legions, and, up to the twentieth century, of emperors and czars. They have been chosen as the national emblems of countries, such as Poland and the USA, by the German Reich and by European armies.

In Australian aboriginal and other primitive cultures, raptors were considered as totem symbols, and they featured in religious rituals and legends. Bald Eagle and Golden Eagle feathers were used by most Indian tribes throughout North America in decorative head-dresses and armbands. Alongside

Some accipitrids, especially the smaller species, tend to build a new nest each year, and in such cases the structure tends to remain relatively small. The basic nest design is a stick platform with a central cup, which may or may not be lined with softer materials. The Grey-faced Buzzard builds a fairly small nest of twigs and sometimes sedges, and lines it with pieces of bark, grass and green leaves. In this species, as in many others, fresh sprigs of green leaves can be added throughout the breeding attempt; the purpose of this behaviour is not clear, but one of the many suggestions is that it may help to camouflage the eggs and young.

[*Butastur indicus*,
Russian Far East.
Photo: Yuri Shibnev]



the more colourful feathers of parrots, macaws or birds of paradise, eagles' feathers, in particular, are still used in various ornamental dresses for religious occasions or hostilities. They are also used in arrows, by some of the forest-dwelling native tribes of South America and New Guinea. In the past, Indians of the Xingu (Mato Grosso) would keep a Harpy Eagle in captivity, as a periodical source of feathers, and Indians in French Guiana rarely miss an opportunity to kill Harpy Eagles or other rain forest eagles, mainly for their feathers. The frequent use of eagles and other large raptors in modern publicity is a proof that they have not yet lost their symbolic power in popular traditions.

Different body parts of vultures and other raptors, from eyes, or whole heads, to feet, feathers and bones, are still used in traditional medicine or sorcery by healers and witchdoctors in many parts of Africa, from Senegal to Ethiopia and South Africa, and also in the Caribbean. Traditional Chinese and other oriental medicines sometimes make use of raptors. Buddhists in Tibet allow Himalayan Griffons and Bearded Vultures to dispose of human corpses, and these are intentionally exposed on rocks near the villages. Parsees in India follow a similar religious custom, and leave their dead at the tops of special towers for ecological disposal by Red-headed and Indian White-backed Vultures.

Falconry has been one of the most intense relationships between man and raptors. Although mainly falcons (Falconidae) are involved in this sport, sparrowhawks, goshawks and eagles are also used regularly. Falconry originated in Asia, maybe in India and China as early as 2000 BC, and probably at first as a method of hunting for food. It is illustrated on an Assyrian bas-relief dated to 722 BC. It was already practised in the first centuries AD almost throughout Asia, from Persia to Japan, and it flourished in the feudal societies of Europe and the Middle East between AD 500 and 1600. It was then often a part of everyday life, not only for the nobility and the gentry, but also for the middle classes, who hunted with "second-rank"

species, including Eurasian Sparrowhawks and Northern Goshawks. Many kings, czars and emperors in Europe, as well as Arab sheikhs, Indian maharajahs, Mongolian khans and Japanese shoguns were all avid falconers, and the tradition is kept alive today by a few thousand dedicated people in Europe, North America and Japan.

However, only in Arabia does falconry remain an institution, with all the state and passion of the royal courts of old times. Nevertheless, it is still used traditionally in central Asia, from Iran to Mongolia, for hunting hares, gazelles, foxes and wolves with Eastern Imperial and Golden Eagles. Similarly, in eastern Turkey and northern Tunisia, at Cap Bon, large numbers of Eurasian Sparrowhawks are trapped during their migration in early spring, then quickly trained and used to hunt quails that pass through later in the season. They were formerly released after the quail hunting period was over, but many are now retained in captivity, because migrants are becoming much less numerous than before.

In the past, when falconry was mostly reserved for fairly few, high ranking people, in order to assure an abundant supply of birds for these falconers, several raptor species received strict protection. Today, despite the development of captive breeding, and the involvement of many falconers in raptor conservation, nest robbing and the trade to provide raptors to inexperienced or unscrupulous falconers is locally a severe additional cause of loss for some raptor populations. On the other hand, escaped birds sometimes settle successfully in the wild, and the breeding population of Northern Goshawks in Great Britain, that was once considered extinct, is said to have been re-established from birds originating from falconry. Accipitrids used today in Europe and North America are mostly Northern Goshawks and, to a much lesser extent, Eurasian Sparrowhawks and Golden Eagles. Occasionally, some other species may be trained, and Harris's Hawk has now become a popular species with falconers in the USA. Quails, partridges, pheasants, rabbits and hares



Given the considerable variation in body size within this family, it is not surprising that there is also a fair degree of variety in clutch size, and while most of the large species lay only one or two eggs, the smallest accipiters and the harriers can lay five or six. The Eurasian Sparrowhawk, probably the best known member of the family, normally lays three to six eggs at intervals of two to three days; up to five chicks can eventually be raised to fledging. If its eggs are lost or destroyed, this species is capable of laying a smaller replacement clutch once or even twice during the same season.

[*Accipiter nisus*.
Photo: B. Speake/Aquila]

are the most favoured game. For the large-scale expeditions that Arab falconers still mount to hunt bustards in North Africa and Pakistan, it is almost exclusively falcons that are used.

The unprecedented reverence offered to raptors through falconry in Europe's Middle Ages was suddenly and dramatically replaced towards the end of the eighteenth century by an obsession, at least as strong, to destroy these same birds which were soon to be labelled "vermin"! This change in human attitudes towards raptors occurred as early as the sixteenth century in parts of England, and overseas emigrants carried with them this new and hostile approach to predators. Prior to this, they had mostly been regarded with indifference, and had been eliminated only locally, when they did persistent damage to free-range poultry, which is still the way they are treated today in many Third World countries. But now they were regarded as enemies, because of their supposed competition with human interests. With the changes in people's ways of thinking, they were also increasingly considered as rapacious and cruel beings; few people knew them enough to admire their beauty or to appreciate their usefulness. Human hunting pressure mounted rapidly, and economic concern led to an increase in the value placed on, and consequently the artificial management of, game populations; at the same time, livestock farming was intensified. Any apparent damage to small game, chickens or lambs became intolerable for many people. The potential benefits brought about by the predatory activities of raptors, such as their controlling of agricultural pests, checking the spread of diseases, and maintaining the balance in nature, were ignored or thought greatly to underweigh their grossly exaggerated or misinterpreted depredations.

Systematic, indiscriminate persecution of raptors was undertaken mainly by hunters, gamekeepers and locally by farmers,

in the belief that this was the only way to prevent the predation of hawks and eagles on lambs, poultry and game species. Persecution was officially encouraged in many countries by the payment of bounties by state or local authorities, and also by land owners, for every "pest" killed. The supposed merits of this widespread policy were so unanimously accepted that even the first people to call for the protection of birds and the ornithologists of the early twentieth century still did not oppose this attitude. Destruction peaked between 1860 and 1960, but then, between 1960 and 1980, birds of prey became partly or totally protected in most developed countries. This legal protection did not completely halt the persecution, especially amongst a significant proportion of hunters who still oppose the official bans and continue to shoot, trap or poison hundreds of raptors even in countries with highly developed conservation movements, such as Britain, France and the USA. Even in northern Scandinavia, eagles and their nests are still destroyed because the birds are blamed for killing young reindeer.

The magnitude of the slaughter sometimes defies the imagination. Considering only the rewards paid for birds actually recovered and officially reported, 88,476 Golden Eagles and White-tailed Sea-eagles, as well as 135,000 other raptors, were killed in Norway alone during the second half of the nineteenth century. Similar huge numbers were eliminated elsewhere, including 128,273 Bald Eagles killed in Alaska in the period 1917-1952, and 147,237 Wedge-tailed Eagles (*Aquila audax*) destroyed between 1928 and 1968, in Western Australia alone. In a relatively small country like Austria, 15,000-22,000 raptors per year were still officially killed between 1948 and 1968. There is a good deal of solid evidence to show that between 1950 and 1970 several million raptors were killed in Europe by hunters and gamekeepers, at a time when numbers had

already been drastically reduced by pesticides. Some species are not yet protected locally, and in Finland, for instance, about 6000 Northern Goshawks are still killed annually by the hunting community.

This persecution led to dramatic declines or even the local extermination of some species over large areas, even before the Second World War. The decline first became apparent from the decreasing numbers of rewards paid. It was especially noticeable for eagles, but such relatively common species as the Red Kite, the Eurasian Buzzard or the Northern Goshawk disappeared from large parts of Britain, Denmark and the Netherlands. Further evidence for the strong influence of this persecution of raptor populations comes from their marked increases, notably in Western Europe, first during the two World Wars, when few gamekeepers remained active, and then later when birds of prey were finally protected in the 1970's. The reduction of population levels also affected their age structure and breeding success. The increased occurrence of birds in immature plumage among breeding pairs of Golden Eagles in Scotland, White-tailed Sea-eagles in Norway or Spanish Imperial Eagles in southern Spain was correlated with the reduction of surplus adult birds and intraspecific competition. Decades of persistent shooting also affected the behaviour of species, and they became much less tame than they are naturally in areas with little or no hunting. This wariness often prevents them from using otherwise suitable habitats that are too close to human habitation or activities.

The most widely used methods of killing included shooting, trapping and poisoning. Raptors were shot anywhere, but particularly destructive methods involved shooting birds at the nest, or from a hide near a live, or mounted, Eurasian Eagle-owl (*Bubo bubo*), a very effective way of attracting birds of prey that come to mob the owl. Thousands of raptors are still shot or caught in nets in southern Europe when they attack the live decoys of the numerous trappers of passerine migrants. Pole traps set in the open were extremely deadly, but their use, now

legally prohibited, has fortunately become marginal. Leg traps placed on the nest, or on a small mound in treeless tundra, or baited with a carcass, are still widely used, even if they are not always primarily intended for raptors. The cage trap, with a live pigeon as a decoy, is a favourite trapping method in Germany and Scandinavia, where it is used to take Northern Goshawks. Shooting eagles from cars along roads, or from aeroplanes, was also widely practised in North America and Australia. The poisoning of carcasses is a widespread cause of mortality among scavengers, such as vultures, eagles, buzzards and kites, even though they themselves are not always the prime targets; strychnine and 1080 (Sodium monofluoroacetate) are among the notoriously infamous products that have frequently been used.

If gamekeepers and shepherds have been, and still are locally, responsible for some of the most serious persecution of raptors, this does not, by any means, account for all of the persecution that these birds have suffered. Shooting for fun at particular points where migrants concentrate is a hobby practised on a large scale. The well known story of Hawk Mountain in Pennsylvania, USA, must be cited. Migrant hawks were regularly slaughtered there in autumn, but the site became a focal point for raptor conservation in the USA, and then an important tool for research and education. Other black points still exist, where tens of thousands of raptors are killed every year, notably in Europe in the Straits of Messina, on Malta, in Lebanon, and along the east coast of the Black Sea. Birds were formerly killed, and still are to some extent, for food, and fat migrants, especially Western Honey-buzzards have been considered a delicacy. Raptors were also used as food for Eurasian Sparrowhawks, themselves caught in large numbers, notably in Turkey and Tunisia, to be trained for quail hunting. Similar large-scale trapping and shooting, mainly for food, occurs in Taiwan and the Philippines, primarily affecting Grey-faced Buzzards. Many migrants are also killed in China for use in traditional cuisine.

Incubation is usually carried out mostly, or entirely, by the female, and males often lack the median brood patch found in females. When the male does actually take an active share of the incubation duties, he nonetheless almost always leaves the female to take the overnight spell. Incubation usually starts with the laying of the first or the second egg, and can last anything from about 28 days in fairly small species, such as the Australian Black-shouldered Kite, to about 60 days in some of the large vultures.

[*Elanus axillaris*,
Western Australia.
Photo: Eric Lindgren/
Ardea]



Egg-collecting, which was a highly respectable occupation for more than a century, is now dying out, but it has accounted for thousands of raptor clutches. Sometimes the incubating female and the alarmed male were shot together, just so that the collector could check the identification of the eggs with greater certainty! Today, disturbance of nests or nesting activities by forestry activities, road building, cross-country vehicles, recreation, cliff climbing and hang-gliding, as well as low-flying aircraft and military exercises, bird photographers and many other kinds of human-related disturbances, almost certainly cause a considerably greater loss of broods than the old-fashioned egg-collecting ever did. Predators take advantage of nests left unguarded by disturbed females. The sensitivity of breeding raptors to disturbance is intensified by their shyness, induced by decades of heavy persecution. The sprouting

up of holiday cottages in many previously undisturbed areas, in conjunction with the promotion of camping, boating and fishing, means that raptor habitats are steadily encroached upon, and few species can readily adapt to this invasion of their habitats. Bald Eagles and White-tailed Sea-eagles are amongst the species most notoriously affected, and most prone to nest desertion. Nest disturbance increases the expenditure of both time and energy in adults, reduces the level of parental care, and affects the nutritional condition of nestlings.

Trade is also locally of great concern. In Europe and North America the trade is mostly limited to providing zoos, exhibitions and falconers, but in Latin America, pet or stuffed raptors are sought by many people as decorations for their homes. The situation is even worse in south-east and eastern Asia, from Indonesia to China and Japan, where birds of prey are much

On hatching, the semi-altricial chick is covered in a thick coat of down. It can clamber about the nest with the aid of its stunted wings, but can scarcely support the weight of its big head; however, it can already see. During the early days it is brooded, almost invariably by the female, to help it combat the intemperances of the climate, such as rain, or excessive heat or cold. The Square-tailed Kite's chick remains in the nest for about two months.

[*Lophoictinia isura*, Australia.
Photo: Michael Morcombe/
NHPA]



The roles of the sexes during breeding are usually quite different, especially in the more aggressive predators. At first, the female remains on the nest most of the time, brooding and guarding the chick or chicks, while the male faces the onerous task of supplying food for both the female and the chicks; he tends to deliver the prey to the female, and she feeds the chicks. About half way through the fledging period, the youngsters are large enough to be left alone, and the female's help is required in order to meet the ever-increasing demand for food. The female Black-breasted Snake-eagle remains with her chick most of the time during 28 days or so, after which time both adults spend long periods hunting and both may feed the chick.

[*Circaetus pectoralis*.
Photo: Peter Steyn/Ardea]



prized, not only as pets or as stuffed birds, but also for food and medicine. The scale of the uncontrolled trade within and between Asian countries is little known at present, but there are certainly some cases in which it constitutes a serious problem.

Status and Conservation

Outside human spheres of influence, raptor populations are usually highly stable. Long-term studies of territorial species show that resident populations vary by no more than 15% of their mean level over many years, even though there is higher variability in the breeding success and overall production of individuals; these results have been found in studies of the Golden and Verreaux's Eagles, the Eurasian Sparrowhawk and the Eurasian Buzzard. Experimental studies provide much evidence that this stability comes from the limitation of density by territorial behaviour, the quality and reliability of the food supply, the availability of nest-sites, and the buffering surplus population of non-breeders. As long as their habitat remained unchanged, whole communities studied in Germany, France, the USA and Kenya retained similar overall population densities and species composition for many years. When populations have been reduced for any reason, they are usually able to recover to about the same levels as previously. Thus, any wide fluctuation in the number of breeding birds is a warning that some unnatural factor may be involved, and that careful research must be undertaken to identify it.

Raptors can play an important part in general conservation strategies for a number of reasons. First, they can take on the role of "umbrella" species, because of their large home ranges, which encompass larger populations of most other species. Second, they are "flagship" species, that are very suitable for arousing public interest and support. Third, they are sensitive bioindicators of environmental changes, particularly in terms

of habitat quality and pollution; they are already used to help monitor forest degradation in the tropics. Finally, their biological role as top predators may be critical for the balance and functioning of ecosystems. Their predation pressure may contribute to the maintenance of high species diversity, by reducing the numbers of dominant prey species, and thus allowing marginal species to survive.

Overall, the worldwide situation of this family is not encouraging. Indeed, the status of few species can be considered well known, and we can give a reliable world population estimate for no more than 20 species (8%), most of them inhabiting temperate zones. From the very scant information available on their past abundance, it appears that many of them had much higher populations one or two centuries ago, and that they are still globally decreasing, if only because of habitat loss. Very few species are actually increasing. Some species may undergo range expansions, but their densities within the range do not increase: the Common Black-shouldered Kite having colonized parts of the Iberian Peninsula, is now spreading towards southern France; the White-tailed Kite is similarly expanding in North and Central America.

A species may increase locally but not elsewhere: the Spanish and French breeding populations of Eurasian Griffons have increased more than fivefold in recent decades, but this may merely be a recovery following protection, and in the meantime other populations are vanishing, for instance in the Balkans and the Middle East. A similar, probably related, increase of Eurasian Black Vultures occurred in Spain, which now holds up to 900-1000 breeding pairs, with a twofold increase over the last five years, but again the species is disappearing from the Balkans and the Middle East, and it is already extinct in several countries. The Eurasian Sparrowhawk and the Northern Goshawk are also recovering, sometimes spectacularly, from recent population crashes in Western Europe, but the eastern population that migrates through Tunisia has declined enormously since World War II.



During the first three weeks of the nestling period, the male of the Pale Chanting-goshawk has to meet all the food requirements of the female and young, in addition to his own. He does not usually visit the nest, but simply leaves the prey for the female to pick up and deal with. She will first feed herself and then pass on food to the young. Although this species regularly lays two eggs, the younger chick normally perishes just a few days after hatching.

[*Melierax canorus*.
Photo: Peter Steyn/Ardea]

Some apparent increases may be only the result of improved knowledge: over 150,000 Lesser Spotted Eagles were tallied during autumn counts of migrants in Israel, when the species was previously thought to number only a few thousand pairs. Because of human-related habitat changes, some species increase numerically, but without expanding their ranges. For instance the Crested Serpent-eagle, the Changeable Hawk-eagle (*Spizaetus cirrhatus*) and the Roadside Hawk, all tropical species of the forest edge and open woodlands, benefit from deforestation, and they are certainly much more widespread and abundant in partially cleared and cultivated areas than they are in primary forest. Hen and Montagu's Harriers probably augmented their ranges and numbers in Europe during the large-scale deforestation of the Middle Ages. Tree planting and the erection of windbreaks in the Great Plains of North America have allowed the spread of species that nest in trees, as have *Eucalyptus* plantations in open areas of South Africa.

Fortunately, at least 50 species throughout the world may be considered globally stable, or even locally increasing, or recovering. Nevertheless, it is difficult to imagine how large their populations were in the past. Many descriptions of various authors from the sixteenth century to the nineteenth suggest massive declines in European populations, in the number of migrants at the Bosphorus, in Egypt, Syria, India and other countries. Sharply declining populations and shrinking distributions are somewhat better documented. A total of 37 species are currently listed as threatened by ICBP/BirdLife International. However, these include species with widely different population sizes, conservation problems and levels of threat.

Several Palearctic species have undergone huge declines in both numbers and breeding distribution. For instance, the Red Kite still occupies most of the countries in which it has been known to breed, but its current estimated total population of 10,000-15,000 pairs is probably a tiny fraction of its former numbers. The White-tailed Sea-eagle is still distributed from Greenland to Kamchatka and south to Algeria, and it may number several thousand pairs, but it has disappeared from large areas within this vast range, especially in western and

southern parts of Europe, and the large, undisturbed wetlands with which it is associated are among the most threatened habitats today. By way of comparison, the Madagascar Fish-eagle (*Haliaeetus vociferoides*), with about 50-100 pairs, may still retain a more substantial fraction of its former population, but, nonetheless, a population which is more fragile, because of its very small size and limited range.

A very patchy distribution, and a low density over a large range with little protection should not be considered a more secure situation than a hundred pairs in a relatively small area, but with higher densities, a good level of monitoring and pertinent conservation measures; such a comparison can be made between the status of the Eastern Imperial Eagle, which ranges from central Europe to western China, and the Spanish Imperial Eagle, endemic to the Iberian Peninsula. A restricted distribution may, in itself, be a great threat when it is associated with moderate density, a patchy distribution and habitat loss, as is the case of the Kinabalu Serpent-eagle of northern Borneo. In contrast to this species, the Andaman Serpent-eagle (*Spilornis elgini*), a congener with a comparable range comprising merely the Andaman Islands, occurs at surprisingly high densities over most of the archipelago, as is often the case with birds of small islands; it may easily number several hundred pairs, a much higher figure than the total population estimated for the threatened Kinabalu Serpent-eagle.

Different populations or subspecies may also have widely divergent status. For example, the nominate race of the Bald Eagle, which breeds in the southern USA, has declined dramatically during the last 150 years, and it is now much smaller than that of the northern race *washingtoniensis* that breeds in Alaska and Canada. The Hook-billed Kite is unevenly distributed and sometimes rare, but it ranges all over Neotropical rain forests. However, its island races *wilsonii* and *mirus*, endemic to Cuba and Grenada respectively, both have extremely small populations which are endangered.

Maybe the most serious concern lies in the tropical rain forests. A total of 109 species of Accipitridae (46% of the world total) are closely associated with dense, wet tropical forests, and at least 40 of these species should probably be considered

Many species are unable to rear more than one chick, even though they may lay a second egg, as a form of insurance policy. The weaker chick, usually from the second, later-hatched egg, is likely to die of starvation after only a few days, but in some cases it is actually killed by its sibling. The reduction of the brood to one means that there is a better chance of the single chick surviving to fledge successfully. Wahlberg's Eagle normally only lays one egg, but on the rare occasions when two are laid, the elder chick invariably kills its younger sibling.

[*Aquila wahlbergi*,
South Africa.
Photo: Clem Haagner/
Ardea]



threatened. The richest tropical forest genera are *Accipiter* with 37 species, *Leucopternis* with 10 species, and *Spizaetus* with 9 species. The current status, ecology and population trends of most of these species are extremely poorly known and inclusions on the Red List of threatened taxa are likely to be very conservative. Moreover, some species, mostly from India to the Philippines and the Solomons, have island populations of relatively restricted range, and numerous well differentiated subspecies, some of which may prove to be full species. The raptor species considered to be the most severely endangered are all tropical forest species: the Madagascar Serpent-eagle, recently rediscovered in north-eastern Madagascar; the Great Philippine Eagle and the Javan Hawk-eagle (*Spizaetus bartelsi*), both of them thought to number roughly 50 pairs, surviving at widely scattered localities; the White-collared Kite (*Leptodon forbesi*) of north-eastern Brazil, only recently confirmed as a valid species; and Gundlach's Hawk (*Accipiter gundlachi*) of Cuba, which is thought to number about 150-200 pairs.

It must be also remembered that the early colonization of many islands by man, well before their discovery by European explorers, resulted in waves of bird species extinctions. In New Zealand, New Caledonia, Hawaii and Reunion, just to mention a few examples, at least seven raptor species are known in subfossil form, and all of them disappeared in the wake of human occupation of their habitats, well into historical times. Among them was the largest eagle known, Haast's Eagle (*Harpagornis moorei*) of New Zealand, which preyed upon the large flightless moas, and disappeared with them, perhaps less than 1000 years ago.

Historically, human persecution has been the most prominent factor in the declines of different raptors (see Relationship with Man). Farmers and hunters, hoping to reduce losses of livestock and game species by the systematic elimination of predators, were powerful agents in the decline of many raptors. However, legal protection of most, if not all, raptors has now been adopted in almost all developed countries, and, as a result of protective measures, deliberate killing has been greatly reduced in recent years in Europe and North America. Nevertheless, ringing recoveries have shown that shooting,

trapping and poisoning, though illegal in most cases, are still significant causes of mortality among raptors in many temperate areas, and legal protection, where it exists, is poorly enforced in Mediterranean and Arab countries. In most inter-tropical regions, raptors tend to be ignored both by law and by the public, but they are killed fairly often for fun, food or feathers, or when attacking poultry. A general trend towards official protection comes from changing attitudes, a better appreciation of the role of predators and a growing concern about the loss of biodiversity.

Poisoning is still widespread, sometimes deliberate, but most often incidental, arising from poisoned baits or carcasses intended for other predators. Vulture populations have particularly suffered from this type of accidental poisoning, and have been virtually eliminated in Greece, the former Yugoslavia, Romania and South Africa.

Pesticides constitute another major issue, one which has been extensively publicized. In the 1950's, the rapidly increasing use of DDT and other persistent organochlorines to control agricultural pests and mosquitoes, or in seed dressings, resulted in the extensive poisoning of insectivorous and granivorous birds, and consequently of their predators. Raptor breeding success was severely affected. Besides cases of acute poisoning and direct mortality, pesticide contamination and the magnification of residues up the food chain, resulted in the accumulation of sub-lethal levels of chemicals, and in the breeding failure of raptors through eggshell thinning, egg breakage and embryo deaths. This led, in turn, to widespread and serious population declines. One of the best examples among the Accipitridae is that of the Eurasian Sparrowhawk, which was very common in Europe, but which almost disappeared from intensively cultivated areas, notably in England and the Netherlands. Its already considerably reduced breeding success was probably further exacerbated by extra mortality, associated with the substantial use of cyclodienes in seed dressings. The species reached its lowest population levels in the early 1960's, but recovered spectacularly, at least in some Western European countries, after the progressive ban of most organochlorines from the late 1960's onwards. These pesticides

are still manufactured and used in developing countries, where temperate migrants, on their wintering grounds, are known to become contaminated.

Many other pollutants, including toxic industrial waste, still affect raptors, at any rate in industrialized or intensively cultivated areas, and significant concentrations of such pollutants may be found locally in individual hawks or eagles; pesticide residues are still found in the tissues of most raptors collected, even sometimes in apparently remote areas of Africa or South America. Polychlorinated biphenyls, or PCB's, are particularly widespread. Heavy metals, such as lead, mercury and cadmium, kill or incapacitate raptors when they reach high concentrations in prey species. Lead poisoning is a significant cause of mortality in Bald Eagles and probably in some populations of Western Marsh-harriers, as both of these species feed extensively on dead or wounded waterbirds that have been shot by hunters, and from which they ingest lead pellets. Organophosphates (formerly parathion, now fenthion) that are used for killing granivorous birds, notably in Africa, often kill huge numbers of raptors, when they concentrate around the roosts or breeding colonies that have been sprayed. Long after the spraying operations, raptors still feed on the highly tempting sick or dying birds. Mass mortality has been reported on numerous occasions after large-scale treatment with highly toxic

rodenticides, such as zinc or thallium sulphates, used in Israel, Malaysia and West Africa. Still now, the widespread application of dicoumarin and other anticoagulants also causes the death of a significant number of kites and buzzards. Molluscicides, used in rice fields, have also killed many Snail Kites, at any rate in Surinam.

Other human-related forms of mortality include electrocution on pylons and collisions with electric powerlines. The importance of both of these as significant factors in overall mortality was long unsuspected, but it now appears to be serious in many areas. For instance, at least 15% of the young Bonelli's Eagles fledged in southern France are found dead under powerlines in their first year. Many raptors are killed by cars, usually when they are attracted onto roads by carrion or voles. Accidents causing injury during the pursuit of prey form a natural cause of mortality, especially among young, inexperienced birds. Many buildings, or other human structures, offer the added risk of collisions, entanglement, drowning in tanks, and so on; for instance, crashing into window panes is a significant cause of mortality for Eurasian Sparrowhawks in some suburban residential areas, as it is for a surprising number of their avian prey.

It is difficult to assess the real impact of direct persecution, poisoning, pesticides, electrocution, collisions and other



The chicks of the Australasian Goshawk hatch with a covering of white down. The first contour feathers are acquired at about two weeks old, and by three weeks old the birds are extensively feathered, although at this stage they are still unable to feed on their own. The complete fledging period in this species ranges from about four to five weeks, after which the young remain dependent on their parents for another five or six weeks.

[*Accipiter fasciatus*, Australia.
Photo: Hans & Judy Beste/Ardea]

human-related mortality, compared with natural mortality rates due to starvation, predation, disease and so on. Although detailed demographic studies have rarely been performed, a simple glance at proportions amongst recorded causes of deaths indicates that man-induced mortality is often dominant in densely populated and cultivated areas. The spectacular recoveries of the Eurasian Sparrowhawk and the Eurasian Buzzard in Western Europe, after the banning, but not the complete elimination, of pesticides and shooting, also show how much these factors were limiting their populations.

Today, and in the long term, the major problems faced by raptors in most parts of the world are the loss, degradation and fragmentation of their habitats, and the associated decrease in quantity and quality of hunting areas, nesting sites and food supplies. Extensive modifications of the landscape have occurred since the beginning of agriculture and early deforestation, but they are now changing the whole face of most countries, far more than ever before, at the same time creating new habitats, thereby eliminating many species, while favouring only a few others. For instance, intensive agriculture, driven on by drastic international policies, is rapidly eliminating the grassland, hedges, woodland, orchards and fallow fields, where passerine birds, rodents, insects and other favoured prey used to thrive. The carrying capacity of the new,

open fields is dramatically reduced, as is the mean density of the breeding populations of raptors traditionally associated with those habitats, such as the Eurasian Sparrowhawk and the Eurasian Buzzard in Europe. Although these two species have recovered well after the pesticide and persecution eras, they have been much more successful in diversified and well wooded areas, where the carrying capacity of the habitat is still much the same as it used to be.

The extensive afforestation of Scottish moorlands with dense, uniform, monospecific pine plantations is said to be detrimental to the Golden Eagle, and, at a later stage, to the Hen Harrier. The drainage of wetlands, which has accelerated in recent decades, has been an important cause of the decline of harriers everywhere, of Bald Eagles in the USA, and of White-tailed Sea-eagles in Europe. Large-scale agricultural schemes in Kazakhstan, in the south of the former Soviet Union, have eliminated or highly disturbed huge areas of steppes that were the breeding habitat of the Pallid Harrier and the Steppe Eagle. Modern forestry often impoverishes the forest fauna and may reduce the density of prey for forest raptors, and ultimately their own density, due to the resultant increase in mean territory size; this is certainly the case in Northern Goshawks. Through increased disturbance and loss of prey, intensive silvicultural management of Central European forests

The chicks grow very quickly, and, once the wing and tail feathers have sprouted, the contour feathers of the body soon follow. The chicks are left alone for increasingly lengthy periods, and the adults' visits to the nest become steadily briefer, as the young birds are able to feed by themselves. They now start to exercise by flapping their wings vigorously on the nest, in preparation for their maiden flight. Young Spotted Harriers fledge at around 36-43 days old.

[*Circus assimilis*.
Photo: Hans & Judy
Beste/Ardea]





Steller's Sea-eagles fledge at about ten weeks old. Up to three eggs may be laid, but usually only one chick is reared, and overall annual average productivity is approximately one chick fledged for every two breeding pairs. A significant proportion of chicks die as a result of falls, either from the nest or with it.

[*Haliaeetus pelagicus*, Kamchatka.
Photo: Rogier Frederiks/
Survival]

may lead to the local extinctions of Lesser Spotted and Eastern Imperial Eagles.

Finally, sprawling urbanization, industrialization and road construction are significant causes worldwide of almost total habitat loss. Among the Accipitridae, only some sparrowhawks and goshawks, in both tropical and temperate zones, as well as vultures and Black and Brahminy Kites, can adapt successfully to densely urbanized areas, and even these, only when enough large trees remain for nest-sites. Where birds are not molested, even large raptors may survive in surprisingly populous towns, for instance the White-bellied Sea-eagle in India and south-east Asia.

The widely publicized deforestation of the tropics is a major threat, and it may be the single most important problem for raptor conservation in the years to come, because of the large number of species it affects. Three detrimental factors are operating, often concurrently. First, deforestation itself involves the conversion of forests to open, cultivated habitats or tree plantations, where very few species can survive. The second factor is the disturbance or degradation of the forest cover through logging, firewood collection, forest management or agroforestry, road building, and the shifting cultivation of indigenous people. Detailed studies in the Neotropics, Africa and south-east Asia have all shown that some primary forest raptor specialists are unable to withstand a high level of disturbance, and soon disappear. Other species have a wider range of tolerance and can survive, at least locally. Another category of species, inhabiting natural gaps and forest edge, are favoured by the openings created, and actually increase in logged or secondary forest and in clearings. Thus, the overall result of degradation is a loss of some species, and a change in the relative numbers of the remaining species. The third component of deforestation is the fragmentation of forest tracts, which threatens the survival of small, isolated populations, which cease to be viable. Species adapted to living within the dense rain forest have proved very reluctant to cross open spaces

between small patches of forest, and they are thus among the least likely to survive. Even hunting pressure alone may eliminate large forest eagles, such as the Harpy Eagle and the Guiana Crested Eagle, in tropical America, probably by lowering prey density below a critical level, and also because of the occasional killing of the eagles themselves.

In the face of such a wide variety of threats, conservationists are using a no less wide array of methods and programmes to slow up the decline of raptor populations. Very active international or national organizations, and also local associations, usually with more enthusiasm than money, are now working in most countries.

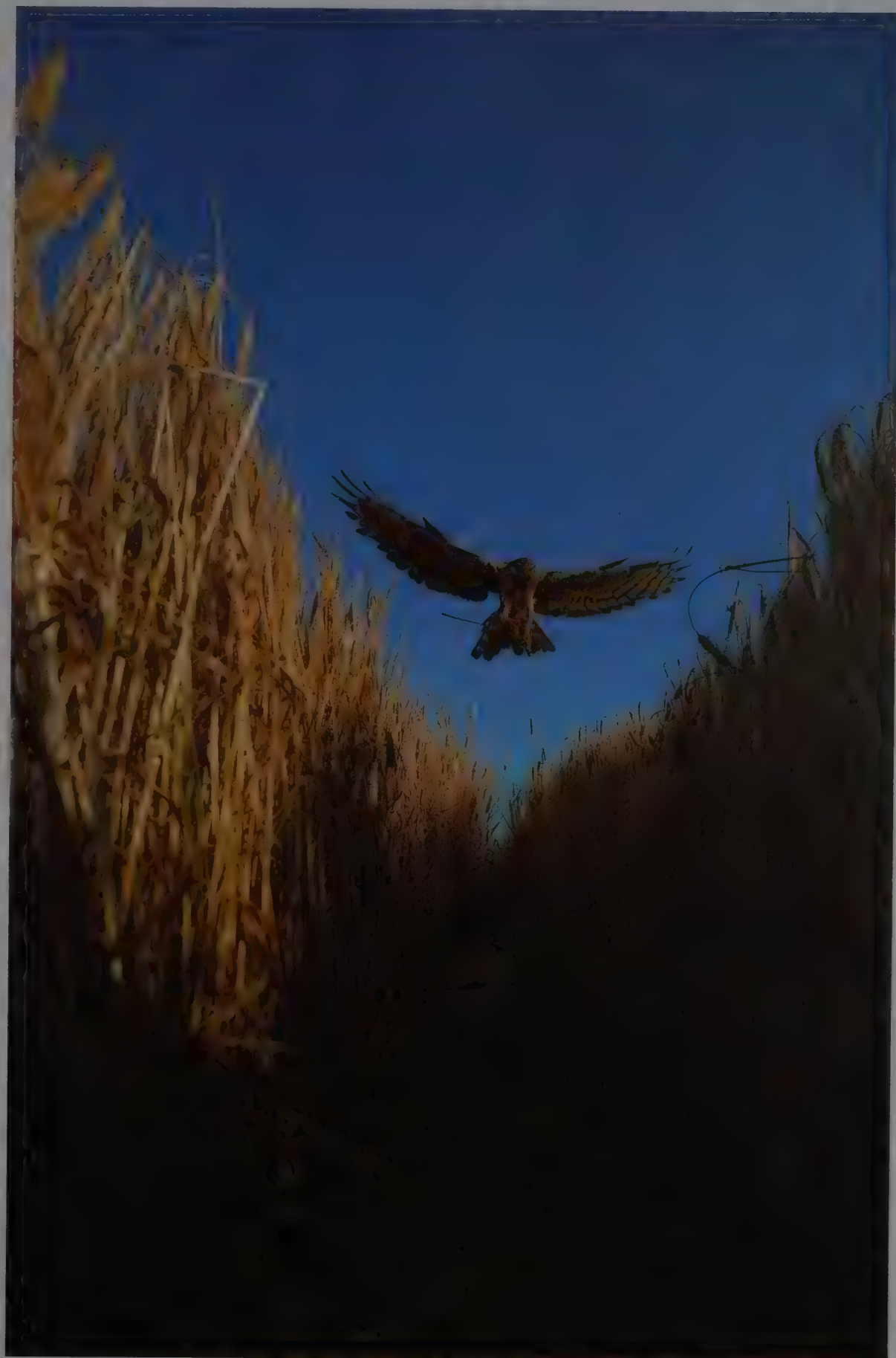
In view of the importance of direct persecution, improving and enforcing the protective legislation is still one of the main aims of organizations devoted to raptor protection. The education of the public, to dispel popular misconceptions, through pamphlets, conferences, museum exhibitions and sometimes live displays of raptors in zoos, or demonstrations by falconers, are also an integral part of these activities. It is also essential for such groups to reduce incidental threats of human origin, for instance by fitting up powerlines so as to reduce the risk of electrocution, and also to campaign for restrictions in the use of pesticides, poisons, lead shot and other environmentally damaging substances. More biologically orientated interventions include habitat management, brood manipulation, reintroductions, artificial feeding and population monitoring.

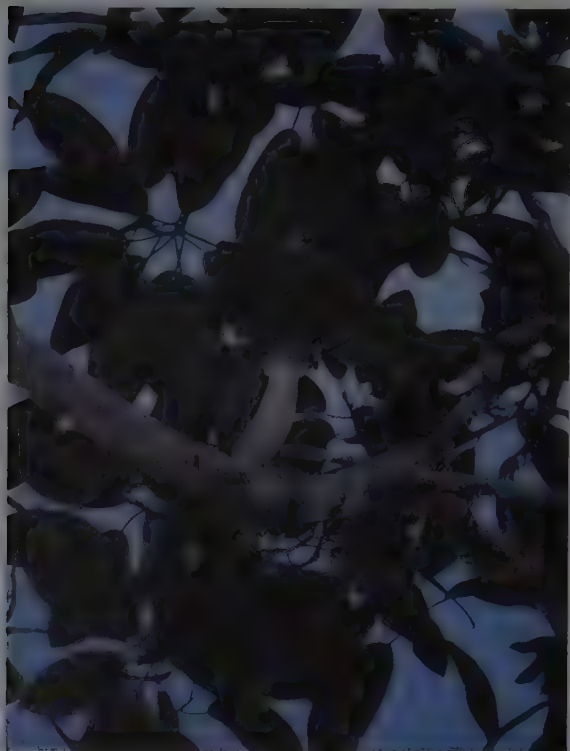
Landscape ecology, metapopulation dynamics and conservation biology provide general rules for maintaining high biodiversity, and rare or patchily distributed species like raptors, on a regional scale. The study of species ecology and minimum viable population size has provided guidelines for the designation of protected areas of suitable size. The conservation of viable populations of all 21 species of true rain forest accipitrids that breed in French Guiana would require the preservation of a continuous tract of undisturbed primary forest of at least 1 million hectares, and preferably much more. Complex

The fates of large numbers of harrier clutches, especially in Western Europe, are tied closely to man's agricultural practices, because several species normally nest in fields of cereals. With the large-scale mechanization and intensification of agriculture, the whole process of the harvest has changed radically: for example, in many areas harvesting now occurs much earlier in the year, some time before the harriers' young have had time to fledge; similarly, a process that formerly took a team of labourers several days to complete is now polished off in a few hours by machines that do not see the nest they are on the point of destroying. In order to combat these problems, many bands of volunteers search out the nests and, often with the assistance and collaboration of farmers, work out various different ways of saving the nests and their contents, without undue disruption to the farmers' interests. Montagu's Harrier is one of the species most seriously affected by the modernization of agriculture.

[*Circus pygargus*.

Photo: Hedio & Van Ingen/
NHPA]





networks of forest patches linked by forest corridors have been proposed in Australia and North America, where large continuous areas of natural habitat are no longer available.

On a more local scale, conservation plans often include a zoning of recreational activities to reduce disturbance in areas critical for the breeding of eagles, for example restrictions on fishing and boating in nesting areas of the Bald Eagle. The elimination of shrub encroachment followed by grazing by sheep, to maintain open grasslands, has been successfully used to improve the hunting habitat of Bonelli's Eagle in southern

France. Promoting more natural forestry policies, and leaving undisturbed areas around nesting trees, during logging operations, has helped to maintain pairs of Bald Eagles or White-tailed Sea-eagles. Providing safe nest-sites and keeping stretches of water open have been instrumental in the recovery of the Snail Kite in Florida. Controlling agricultural development, cattle ranching and military training activities on range lands in Idaho have been critical in the management of the rich breeding community of raptors of the Snake River Valley. Planting hedges and woods and leaving patches of fallow land amidst the vast cultivated croplands of North America have increased the distribution and density of several species of raptors. The construction of large reservoirs has created many new breeding or wintering habitats for Black and Brahminy Kites, Bald Eagles, sea-eagles, and fishing-eagles among others. Finally, management of powerlines, by providing platforms on pylons or alternative nest-sites nearby, has allowed eagles in western North America and also in South Africa to colonize treeless plains.

Habitat management often improves prey diversity and density, but direct feeding is also used to reduce winter mortality, or to provide uncontaminated food, for instance for the White-tailed Sea-eagle in Sweden. Providing carcasses for vultures has been extremely successful in Europe and South Africa. These "vulture restaurants" are also used for ecotourism and education, as well as to reduce the risks of shooting and poisoning, by attracting vultures into safe areas. Feeding previously unsuccessful pairs of Bonelli's Eagles and Egyptian Vultures in southern France has spectacularly increased their breeding performances, thus demonstrating how a scarce food supply was limiting their breeding success.

The unintentional introduction of rats, mice, rabbits, sparrows and starlings to Australia and North America has provided abundant food sources for several raptor species and has led to an increase of the populations involved. The fact that domestic pigeons or released pheasants appear very attractive to Northern Goshawks in Europe, probably increases the survival rate of immature birds, but is, at the same time, perhaps the cause of their persecution by pigeon-fanciers and gamekeepers, despite official protection. Scavenging raptors in many tropical towns, and formerly in Europe, obviously

Very little is known about the Semiplumbeous Hawk, which inhabits humid forests from Honduras south to north-west Ecuador. Its current listing as a near-threatened species is more a reflection of this absence of hard data, rather than of any decline. The species is fairly common in parts of Colombia, where it is also known to occur in mature second growth.

[*Leucopternis semiplumbea*, Tortuguero National Park, Costa Rica.
Photo: William Grenfell]



Formerly more widespread in Spain and also occurring west into Portugal and south into Morocco, the Spanish Imperial Eagle has declined considerably over the last 80 years, to become one of the rarest of all raptors, now numbering only about 150 pairs. It is currently the object of a major conservation campaign, which aims to increase the extent of its habitat under protection and reduce the alarming amount of mortality caused, often indirectly and accidentally, by humans. A captive breeding programme has recently been launched.

[*Aquila adalberti*.
Photo: José Luis González Grande/
Bruce Coleman]

The Black Harrier, a species that breeds only in South Africa, is currently considered near-threatened. Within its specialized fynbos breeding habitat it is still widespread and locally common, but this habitat type is already fairly restricted and it has been severely degraded. The species will also breed in fields of cereals, but here it faces the additional threat of contamination from pesticides.

[*Circus maurus*,
Stanford, Cape Province,
South Africa.

Photo: J. J. Brooks/Aquila]



benefit from the superfluity of rubbish, offal from slaughterhouses and excrement, but these species disappear rapidly when hygiene and urban sanitation improve. Similarly, a crash in the population of a prey type, such as that due to myxomatosis in Europe, may result in a substantial decrease in rabbit predators. The rarefaction of swarming locusts in the Sahel zone of Africa, after many years of systematic spraying operations, has probably been influential in the decline of the Montagu's Harriers that used to exploit this superabundant resource in their winter quarters.

The settlement of breeding populations of some raptors in urban or suburban areas is a recent phenomenon that may help the survival of the species involved. A growing number of cities in Europe, North America and Australia have significant populations of an increasing number of species. Sparrowhawks and even goshawks are the most frequent colonists, and they may reach high densities in the centre of large towns, for instance the Eurasian Sparrowhawk population studied in Prague, where breeding success was shown to be better than that of rural breeders. The Mississippi Kite, in south-eastern North America, has also now established several colonies in urbanized areas. Other highly artificial habitats are regularly exploited by some raptors, for instance the wide grassy embankments along highways, which are often much richer in rodents than the surrounding agricultural areas.

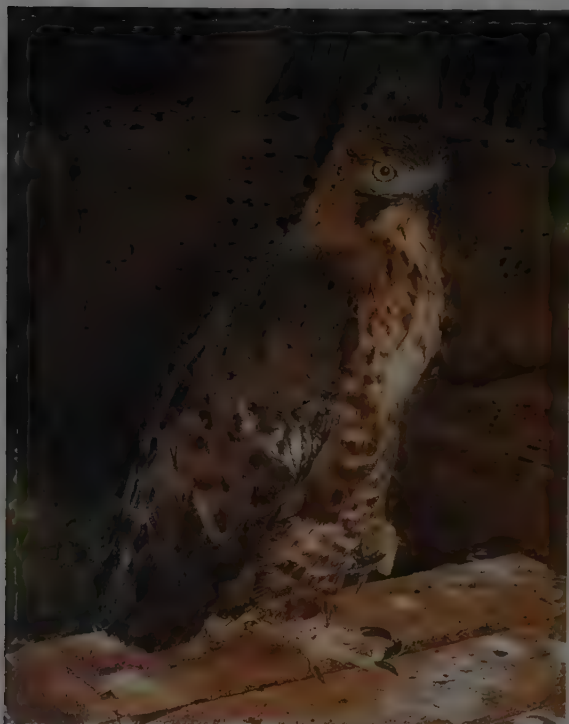
A wide variety of techniques have been used to prevent local extinctions, to halt declines, or to help species to recover. The permanent protection of nesting sites is not always feasible, and must be superseded by active nest guarding, to avoid disturbances, and to prevent eggs or chicks being stolen by collectors or falconers. In France, nearly 1300 volunteers watch over more than 1800 nests of threatened raptors each spring, to prevent human interference which can often cause the loss of whole broods. Safe artificial nest-sites are occasionally provided, mainly in reconstructed or rehabilitated ecosystems, for example sites for the Ferruginous Hawk in strip-mined areas of the north-western USA. A considerable proportion of harriers in Western Europe now breed in cereal fields, and consequently their nests are destroyed at harvest time, which usually arrives before the young have fledged. It is a time-consuming activity, for scores of volunteers, to locate the nests and shift them

before the harvest, or persuade the owner to maintain a patch of unharvested crops around the nest, or take out the nestlings and replace them after the harvest in the original nest, fenced off against potential predators; such dedicated steps are taken for over 1500 nests in France each year.

Brood manipulation is used to increase the productivity of several depleted populations. It was first used in Central Europe for the Lesser Spotted Eagle, as the chick that hatches second is always killed by its elder sibling. With the manipulation, the younger chick is removed just after hatching, placed in an active nest of a common foster species, for instance a Eurasian Buzzard, and then returned to its original nest 1-2 weeks before fledging, by which time sibling aggression is almost suppressed, and the adults may still accept the newcomer. The transfer of eggs from threatened clutches, from healthy populations, from captive birds, or from wild broods with abnormally low success, is another way of improving the breeding success of populations, when lack of food is not the limiting factor. Double-clutching, the removal for artificial incubation of the first clutch to induce a female to lay a second one, is used in captive pairs, and sometimes in the wild, in order to raise more young, and perhaps allow transfers.

An increasingly popular conservation measure is the reintroduction of a species to an area from which it had been previously eliminated, usually due to human persecution or pesticide contamination. Two main techniques of release are used. For solitary species, the most appropriate way is to put well grown nestlings on a specially prepared nest, and feed them until they are able to fend for themselves. This system was used to re-establish breeding populations of White-tailed Sea-eagles and Red Kites in Scotland, and also for Bald Eagles in several areas of the USA. Similar projects are under way with the aim of reintroducing the Bearded Vulture throughout the Alps, and the Eurasian Black Vulture in France. The same technique, or the release of birds already able to fly, is also used to strengthen small or declining populations, such as that of Eurasian Black Vultures on the Mediterranean island of Mallorca.

The most successful reintroduction project of any member of the Accipitridae has been that of the Eurasian Griffon in south-central France. It has been achieved by a technique



adapted to the highly social behaviour of this species. Birds were kept in aviaries at the site where they had last been known to breed, until they were released in groups of adults at the beginning of the courtship period. This minimized the risk of dispersal, and ensured that the birds would breed there, if anywhere, soon after release. From 1982 to 1986, altogether 61 birds were released. In 1993 the colony comprised 132 birds, and 34 pairs fledged 22 young, with a total of 117 already fledged in the wild. The individuals used for reintroduction came in varying proportions from three sources: young taken from the nests of healthy populations elsewhere; moderately

injured birds, treated and rehabilitated, before being returned to the wild; and birds produced by captive breeding programmes and donated by zoos.

Captive breeding programmes are now being developed for more and more species in several different countries. They most often use falconers' birds or those that are permanently injured, and serve to provide birds for release in the wild, for educational displays by falconers, and to increase expertise in raptor manipulation and veterinary medicine. Captive breeding must only be used as a last resort, to save or re-establish a wild population in conjunction with habitat conservation, population management, improved and enforced legislation and, if necessary, public education to eliminate hostile attitudes towards birds of prey and minimize human disturbance.

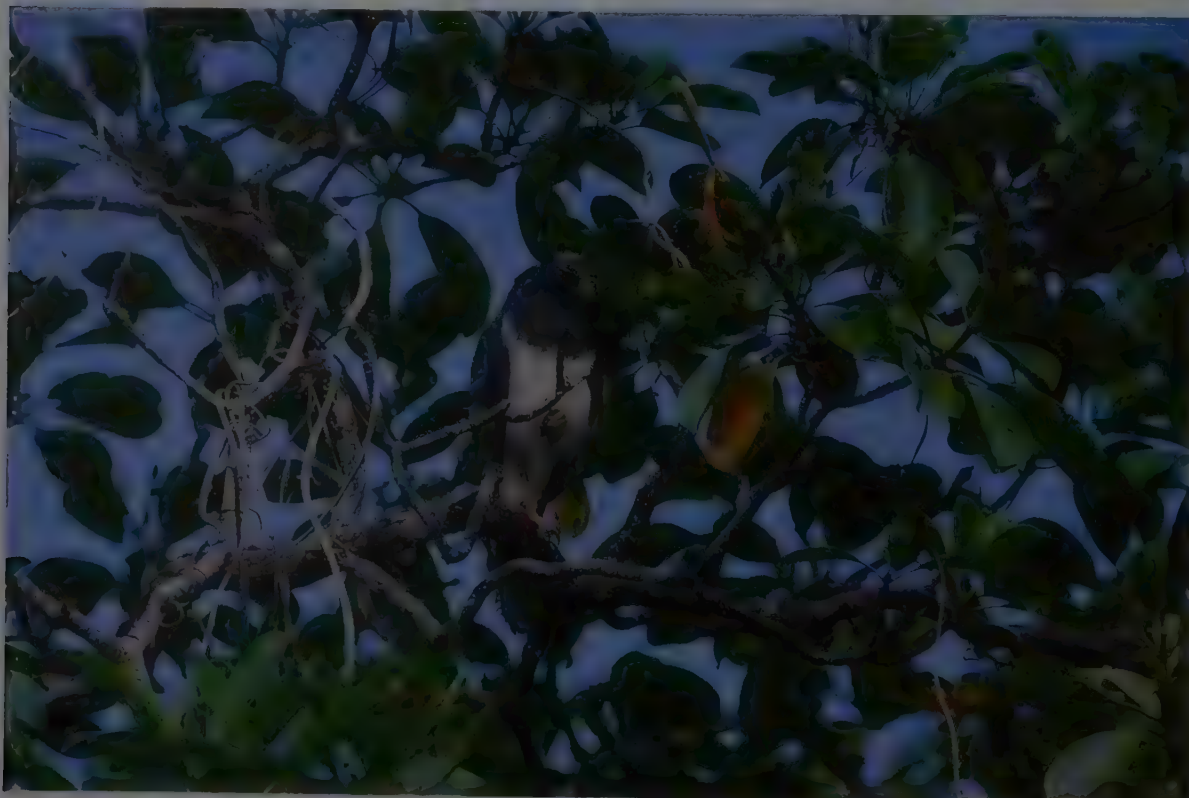
Raptor conservation programmes in tropical countries currently encompass global management plans, including forest conservation, economic incentives for sustainable use of forest by local people, hunting regulations, improvement of agricultural practices, development of ecotourism and training of local students and rangers. The Peregrine Fund, of Idaho (USA), has been extremely active in this field, and has launched the following successful programmes, amongst others involving temperate species or other Falconiformes.

The Harpy Eagle Conservation Programme works co-operatively with Latin American governments, organizations, logging companies and local people to conserve forests and breeding sites of Harpy Eagles. At the same time, it develops captive breeding and release techniques, with the aim of re-establishing the species in areas where it has been lost, but where suitable habitat remains, and also for the management of small, isolated populations. More than ten nests are monitored in Venezuela, Panama and Guyana, and surveys are being carried out in Colombia, Ecuador and northern Central America. Flying young have been fitted out with satellite-monitored radio transmitters, to permit the study of their dispersal, and adults have been equipped with standard ground-read transmitters, so that their habitat use can be monitored. A dozen birds are kept for captive breeding and for the subsequent release of their offspring.

The Philippine Eagle Project is aimed at preventing the extinction of what is perhaps the world's largest and most spectacular eagle, and restoring a self-sustaining population of

During the 1980's the total population of the Javan Hawk-eagle was estimated to number only some 50-60 pairs. A special project was launched in 1990 with the initial aim of obtaining a clearer picture of the overall numbers, and these are now reckoned to be very slightly higher than was thought, but still perilously low. In addition to the major factor of deforestation, the capture of birds for sale appears to be contributing to the decline of this species, although the Indonesian government has recently taken steps to toughen the measures against such illegal trade.

[*Spizaetus bartelsi*, Jakarta, Java.
Photo: Michael Riffel]



Although it has a very limited range, the New Caledonia Sparrowhawk occurs at surprisingly high densities, with almost six birds recorded per square kilometre in areas of optimum habitat. Recent survey work suggests that the total population of this species is likely to be in excess of 5000 pairs, and at present there is no evidence to suggest any decline.

[*Accipiter haplochrous*, New Caledonia.
Photo: Thierry Petit/Bios]

The plight of the Great Philippine Eagle is desperate, with total numbers reckoned to be under 200 individuals in the wild. Populations are now highly fragmented, and, with relentless human encroachment on the few remaining patches of suitable forest, together with continued shooting and capture for trade, very drastic measures are now required, if this magnificent species is not to disappear in the wild within a few decades.

[*Pithecophaga jefferyi*,
Mindanao, Philippines.
Photo: Günter Ziesler]



this endangered species to one of its last remaining strongholds on the island of Mindanao, in the southern Philippines. Two chicks have been bred in captivity, and an important education and socio-economic programme is in progress. This includes reforestation operations, finding, monitoring and protecting nest-sites, with the help of settlers and villagers, and also an exchange between local and North American schools.

The Maya Project in Guatemala uses raptors as an environmental focus for the conservation of tropical forests and for building up local conservation capacity in Central America. It is unique in the amount of new information that has been accumulated on secretive tropical forest raptors, and in the training and participation of a large number of Latin Americans.



The scarcity of field work carried out in the Andaman Islands has probably been mainly responsible for the Andaman Serpent-eagle being classified as a threatened species. As the human population of these islands is rapidly growing, the bird's forest habitat may well come under threat in the future, but for the time being the species remains common.

[*Spilornis elgini*,
Andaman Islands.
Photo: W. S. Clark]

Within an area of some 2.2 million hectares, in the contiguous border parks of Guatemala, Mexico and Belize, it conducts studies of as many species as possible in natural habitats, and also those altered by humans, in order to find out how various forms of land use affect the forest and its raptors. It tests and improves methods for monitoring tropical forest species. Sixty permanent 1 km² plots have also been established and census work carried out, as a basis for long-term monitoring of the populations and the effects of deforestation, habitat fragmentation, hunting and other potentially significant factors.

The Madagascar Fish-eagle Project also fits into this general strategy of broad integrated conservation and development programmes, aimed to provide local people with sustainable alternatives to habitat destruction, while protecting natural areas to conserve biodiversity and especially valuable species. A wetland area of western Madagascar has been selected, as up to half of the entire population of the endemic eagle breeds there. The project is carrying out ecological and conservation studies, in addition to experimental management, but it is also involving the local Sakalava people, who, with their knowledge and their traditional use of the wetlands, help to contribute towards the selection of areas for special reserves that will protect the area's natural habitats and endangered species. These reserves will integrate conservation with the traditional customs and use of resources by the local people, and will enable them to become guardians of the wetlands and their threatened fauna.

General Bibliography

- Amadon & Bull (1988), Anon (1983), Barton & Houston (1993), Brown (1976a), Brown & Amadon (1968), Burton & Boyer (1989), Chancellor (1977), Chancellor & Meyburg (1986, 1991), Cooke *et al.* (1982), Grossman & Hamlet (1964), Hill (1944), Holdaway (1994), Kemp & Crowe (1991), Meyburg & Chancellor (1989, 1994a), Newton (1979, 1985a), Newton & Chancellor (1985), Newton & Olsen (1990), Rutgers & Norris (1970), Sibley & Ahlquist (1990), Sibley & Monroe (1990), Sibley *et al.* (1988), Stresemann & Amadon (1979), Swann (1924-1945), Weick (1980).



PLATE 3

inches 10
cm 25

Genus *AVICEDA* Swainson, 1836

1. African Cuckoo-hawk

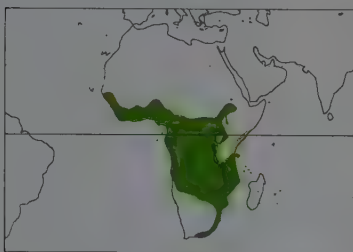
Aviceda cuculoides

French: Baza coucou **German:** Kuckucksweih **Spanish:** Baza Africano
Other common names: (African) Cuckoo-falcon, African Baza

Taxonomy. *Aviceda cuculoides* Swainson, 1837, Senegal.
Forms superspecies with *A. madagascariensis*, and possibly also with *A. jerdoni* and *A. subcristata*.
Three subspecies recognized.

Subspecies and Distribution.

A. c. cuculoides Swainson, 1837 - woodland from Senegal E to SW Ethiopia and S to Nigeria and N Zaire.
A. c. batesi (Swann, 1920) - lowland rain forest from Sierra Leone E to E Uganda and S to N Angola.
A. c. verreauxii Lafresnaye, 1846 - woodland and coastal, riparian and montane forest from Kenya S to N Namibia and South Africa.



Descriptive notes. 40 cm; 220-296 g; wing-span 91 cm. Perches horizontally on short legs, often with wings slightly drooped. Small nuchal crest and rufous patch at all ages. Juvenile, brown above with large brown spots on white underparts, similar to juvenile *Accipiter tachiro*. Subadult plumage with rufous wash to chest and finer grey barring on underparts. Brown eye in juvenile turning pale yellow in subadult; in adult, bright yellow in female, red in male. Races separated by size, extent of barring and intensity of plumage colour.

Habitat. Interior and edges of evergreen, riparian and coastal forest, patches of dense deciduous woodland or exotic plantations in more open savanna, up to 3000 m.

Food and Feeding. Lizards, especially chameleons, and large insects, including grasshoppers, mantids and caterpillars. Also beetles, wasps, termite alates, crabs, fish, small birds and bats. Perches for long periods, usually within cover, then swoops slowly down to take prey from foliage or branch, or by hopping along the ground. Occasionally hawks aerial insects, or courses low over open vegetation to drop on prey, flying with relaxed kite-like flight or soaring to display chestnut underwing.

Breeding. Mainly in rainy season: laying Jun-Jul in Sierra Leone; Jun in Nigeria; Feb in Gabon; Mar, Aug-Nov in E Africa; Apr, Oct-Nov in C Africa; Sept-Mar in S Africa. Whistling calls and rocking-and-rolling flight displays distinctive. Builds typical flimsy and untidy platform of twigs with leaves still attached, placed high in the canopy. Usually 2 eggs (2-3); incubation 32-33 days; chicks have white down; fledging 30-42 days; sexes share care of the young, but male does not usually provision female.

Movements. Resident in most areas but some seasonal movement into coastal Kenya to breed in Apr-Nov and into Transvaal highveld after breeding in May-Aug. May move locally within deciduous woodland in response to fluctuations in chameleon and insect numbers, leading to irregular influxes in areas of E and S Africa. Small-scale seasonal movements have also been detected in W African savannas.

Status and Conservation. Not globally threatened. CITES II. Generally common around forest edges, less common in woodland. Easily overlooked, and so may be found to be more common, especially as a breeding species. Affected by loss of prime habitat through cutting of forest and woodland, but uses many secondary habitats including suburban gardens. Subject to predation by sympatric raptors, some of which also colonize secondary habitats or plantations. Not known to be affected by pesticide use.

Bibliography. Ade (1985), Benson & Benson (1975), Brown & Bursell (1968), Brown *et al.* (1982), Carlyon (1987), Chittenden (1984), Dewhurst *et al.* (1989), Finch-Davies & Kemp (1980), Ginn *et al.* (1989), Grimes (1987), Hall *et al.* (1991), Jeffery (1977), Jones, J.M.B. (1985), Lewis & Pomeroy (1989), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Pickford *et al.* (1989), Pinto (1983), Searle (1993), Tarbuton & Allan (1984), Thiollay (1978c), Vernon (1979), Weaving (1977).

2. Madagascar Cuckoo-hawk

Aviceda madagascariensis

French: Baza malgache **German:** Lemurenweih **Spanish:** Baza Malgache
Other common names: Madagascar Baza, Madagascar Cuckoo-falcon

Taxonomy. *Pernis Madagascariensis* A. Smith, 1834, Madagascar.



Forms superspecies with *A. cuculoides*, and possibly also with *A. jerdoni* and *A. subcristata*. Monotypic.

Distribution. Madagascar.

Descriptive notes. 40-45 cm. Pale rump distinctive; dull brown without bright colours of plumage or soft parts of African congener *A. cuculoides*. Sexes similar. Juvenile has brown eyes, but other differences not described. Resembles sympatric *Buteo brachypterus*.

Habitat. Evergreen and dry deciduous forest from sea-level to 1600 m; clearings within forest, e.g. around villages and towns, and some palm plantations.

Food and Feeding. Mainly small reptiles, e.g. chameleons and geckos, and large insects, including grasshoppers. Hunts from a perch, gliding down to take prey from foliage. Usually perches within canopy, often on the edge of a clearing. May be active at dusk.

Breeding. Laying Oct-Dec. One nest 1.4 m up in crown of tree. Pair recorded feeding chicks with insects; chicks have white down. No other details recorded.

Movements. None recorded.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Occurs throughout Madagascar and is fairly common in all forest zones, least so in the dry S and deforested central plateau.

Bibliography. Benson *et al.* (1976), Dee (1986), Langrand (1990), Langrand & Meyburg (1984), Milon *et al.* (1973), Rand (1936), Salvan (1971).

3. Jerdon's Baza

Aviceda jerdoni

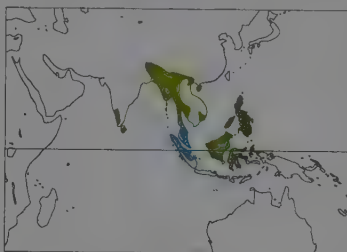
French: Baza de Jerdon **German:** Hinduweih **Spanish:** Baza Oriental
Other common names: Blyth's/Legge's/Crested Baza, Brown/Crested Lizard Hawk

Taxonomy. *Pernis Jerdoni* Blyth, 1842, no locality = Bengal.

Probably forms superspecies with *A. cuculoides*, *A. madagascariensis* and *A. subcristata*; all four sometimes considered conspecific. Five subspecies recognized.

Subspecies and Distribution.

A. j. ceylonensis (Legge, 1876) - SW India and Sri Lanka.
A. j. jerdoni (Blyth, 1842) - NE India through Burma, S China (SW Yunnan, Hainan), Thailand and parts of Indochina to N Malay Peninsula; some movement S for winter.
A. j. borneensis (Brüggemann, 1876) - Borneo.
A. j. magnirostris (Kaup, 1847) - Philippines.
A. j. celebensis (Schlegel, 1873) - Sulawesi, Banggai Is and Sula Is.



Descriptive notes. 41-48 cm; 350 g; wing-span 117 cm. Medium-sized brownish kite with long crest; dark crest feathers have white tip; flies with soft wingbeats of paddle-shaped wings. Female fairly similar to male in size and plumage, but lacks grey on head and upperparts. Juvenile like female, but head darker and breast streaked; has one more, narrower tail band. Races generally differ mainly in size and intensity of coloration, ranging from dark and strongly patterned in Sulawesi to pale in Sri Lanka.

Habitat. Moist deciduous to evergreen tropical forest, forest edge and clearings, in foothills from 200 m to 1100 m; also around quiet backwaters; typically in rain forest, but in Sumatra mostly recorded in swamp forest; occurs over mountain grassland in Sulawesi. Nests in forest in canopy of large trees, occasionally in tea plantations.

Food and Feeding. Chiefly insects, but also lizards (e.g. *Calotes*) and frogs; one record of small snake. Hunts from perch, making short sallies to ground when prey sighted. Reports of crepuscular activity not verified.

Breeding. Poorly known. Season Apr-Jun in NE India; Feb-Apr in SW India; Nov-May in Sri Lanka. Small, compact nest usually in crotch or in crown of large tree, 7-20 m up; lined with green leaves. Spectacular display flights over nest area in forest include mutual soaring and undulating flight, accompanied by vocalizations. Usually 2-3 eggs. Juveniles dependent on parents for some time after fledging. No further information available.

Movements. Sedentary; recorded throughout year in virtually all of range. Some birds, possibly juveniles, from N of range apparently disperse or migrate S into Thailand, where movements recorded, and into Malay Peninsula, where only records are in winter.

Status and Conservation. Not globally threatened. CITES II. Appears to be relatively uncommon to rare throughout range; might even be threatened, as rare almost everywhere and largely restricted to undisturbed or only slightly disturbed forest, which is fast disappearing. Nevertheless, may be commoner than thought, and simply not detected due to unobtrusive habits. Widespread in Kalimantan; uncommon in Philippines. Status uncertain in Sumatra, where may be resident, with recent records from E coast in May and Aug. Several recent records from N & S Vietnam; also known from S Laos, suggesting species may be resident throughout Indochina. Also reported from E Ghats of SE India.

Bibliography. Ali & Ripley (1978), Betts (1953), Bishop *et al.* (1995), Cheng Tso-hun (1987), Dickinson *et al.* (1991), Goodman & González (1990), Henry (1971), Holmes & Burton (1987), King *et al.* (1975), Lekagul & Round (1991), van Marle & Voous (1988), Medway & Wells (1976), Meyer de Schauensee (1984), Rand & Rabor (1960), Riley (1938), Smythies (1981), Stresemann (1940a).

4. Pacific Baza

Aviceda subcristata

French: Baza huppé **German:** Papuaweih **Spanish:** Baza Australiano
Other common names: Crested/Lizard Hawk, Crested/Lizard Baza

Taxonomy. *Lepidogenys subcristatus* Gould, 1838, New South Wales.

Probably forms superspecies with *A. jerdoni*, *A. cuculoides* and *A. madagascariensis*. Populations of Solomon Is now regarded as single race, thus possible races *proxima* and *robusta* now included in *gurneyi*. Race *njikena* of NW Australia doubtfully separable from nominate *subcristata*. Thirteen subspecies currently recognized.

Subspecies and Distribution.

A. s. timorluensis (A. B. Meyer, 1894) - islands off Sulawesi, Lesser Sunda.
A. s. pallida (Stresemann, 1913) - S Moluccas.
A. s. reinwardtii (Schlegel & S. Müller, 1841) - C Moluccas.
A. s. stresemanni (Siebers, 1930) - Buru (C Moluccas).
A. s. rufa (Schlegel, 1866) - N Moluccas.
A. s. waigeuensis Mayr, 1940 - Waigeo I.

- A. s. obscura* Junge, 1956 - Biak I.
A. s. stenozona (G. R. Gray, 1858) - W New Guinea, Aru Is.
A. s. megala (Stresmann, 1913) - E New Guinea.
A. s. coultasi Mayr, 1945 - Admiralty Is.
A. s. bismarckii (Sharpe, 1888) - Bismarck Archipelago.
A. s. gurneyi (Ramsay, 1882) - Solomon Is.
A. s. subcristata (Gould, 1838) - N & NE Australia.



Descriptive notes. 35-46 cm; 227-448 g; wingspan 80-105 cm. Resembles most others in genus, particularly *A. cuculoides*. Adult grey with crest and bold ventral barring, unmistakable within range. Female slightly larger than male. Juvenile brown, not grey, with bold face pattern and rufous patch on breast. Slight regional variation in size, colour and nature of ventral barring.

Habitat. Rain forest, open forest, woodland and edge, including farmland and urban trees; from sea-level to 1000 m in Australia, and to 1700 m in New Guinea. Nests in forest and woodland, often in riparian woodland.

Food and Feeding. Omnivorous. Mainly eats foliage insects and tree-frogs; also lizards, small birds and nestlings, and small fruits. Forages by low quartering of tree canopy, or still-hunting within canopy, inspecting foliage; sometimes clambers about among branches. Glides or drops to snatch prey from foliage.

Breeding. Sept-Jan in Australia; season apparently longer, extending into early dry season (austral autumn) in New Guinea. Solitary. Nest is small platform of twigs 25-40 cm wide, 12-15 cm deep, lined with green leaves, within tree canopy, 6-35 m above ground. Usually 2-3 eggs (2-4); incubation c. 29-33 days; chicks have white down; fledging 32-35 days. Age at first breeding at least 2 years. Storms sometimes destroy nests and eggs or young.

Movements. Mostly sedentary. Extreme SE populations (Australia) partly migratory, making some local altitudinal and N-S movements, and wintering on subtropical coasts.

Status and Conservation. Not globally threatened. CITES II. Common in tropics, uncommon at extremities of Australian range. Probably benefits from fragmentation of continuous dense forest, as it prefers edges, although absent from extensively cleared areas. Possibly affected by pollutants such as lead in heavily urbanized areas.

Bibliography. Andrew (1992), Beehler *et al.* (1986), Bell (1984), Bowler & Taylor (1989), Coates (1985), Cupper & Cupper (1981), Czechura (1993), Hollands (1984), Ley (1990), Marchant & Higgins (1993), Olsen & Maples (1993), Olsen, Crome & Olsen (1993), Schodde (1977), Schodde & Tidemann (1988), White & Bruce (1986).

5. Black Baza

Aviceda leuphotes

French: Baza huppard **German:** Dreifarbenweih **Spanish:** Baza Negro
Other common names: Black-crested Baza, Black-crested Lizard Hawk

Taxonomy. *Falco leuphotes* Dumont, 1820, Pondicherry, India.

Race *wolfei*, based on single specimen, doubtfully distinct from nominate. Birds from Burma and Thailand may belong to race *syama*, as opposed to rather similar nominate *leuphotes*; these birds sometimes awarded separate race, *burmana*. Four subspecies normally recognized.

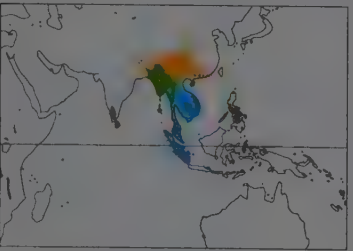
Subspecies and Distribution.

A. l. wolfei Deignan, 1948 - Sichuan (C China).

A. l. syama (Hodgson, 1837) - NE India and E Nepal E to S China (Guangdong, Hainan); winters S through Indochina and Malay Peninsula to Sumatra.

A. l. leuphotes (Dumont, 1820) - SW India, S Burma and W Thailand; may also breed in parts of Indochina.

A. l. andamanica Abdulali & Grubb, 1970 - South Andaman I (Andaman Is).



Descriptive notes. 30-35 cm; 168-224 g; wingspan 66-80 cm. Small black kite with long crest; in flight, appears pied, and looks more like corvid than accipitrid. Female similar to male, but lacks white on secondaries. Juvenile also similar, but duller with white streaks on throat. Racial differences rather slight: *syama* has longer primaries, and barring on underparts probably averages blacker; single specimen of *wolfei* seems identical to many individuals of previous race and also nominate; both specimens of *andamanica* show only two bars on upper belly, and also differ from other races in unbarred flanks.

Habitat. Open deciduous or evergreen tropical forest, especially around clearings and wide streams, from sea-level up to 1000 m. Gathers to spend night at communal roosts in winter.

Food and Feeding. Mainly large insects, especially grasshoppers, but also lizards and frogs; occasionally small mammals and birds. Hunts from perch, making short sallies to take insects in flight; also takes prey from leaves or ground. Sometimes hunts in small flocks. More active when overcast and at dawn and dusk; at times gregarious.

Breeding. Breeding accounts scarce. Season Mar-May in Burma; Feb-Jun in SW India; Apr-Jun in NE India. Small, compact nest built by pair, 20-30 m up in large forest tree, often near water, lined with grass and green leaves. Usually 2-3 eggs; both sexes incubate. No further information available.

Movements. Migrants from N parts of range move S through Malay Peninsula in Nov-Dec to winter in Sumatra, returning in Feb-Mar. A few migrants recorded in SE India and Sri Lanka.

Status and Conservation. Not globally threatened. CITES II. Generally uncommon, but probably passes undetected due to unobtrusive habits, and may be commoner than thought. Seen in large numbers on migration in Malay Peninsula. Widespread destruction of forest throughout much of range is only known threat.

Bibliography. Abdulali & Grubb (1970), Ali & Ripley (1978), Andrew (1992), Chong Tso-hin (1987), Deignan (1948, 1948), Biechocup & Hue (1978), Henry (1971), Inskipp & Inskipp (1985), King *et al.* (1975), Lekagul & Round (1991), van Marle & Voous (1988), Medway & Wells (1976), Meyer de Schauensee (1984), Riley (1938), Smythies (1986), Tikader (1988).

Genus *LEPTODON* Sundevall, 1836

6. Grey-headed Kite

Leptodon cayanensis

French: Milan de Cayenne **German:** Cayenneweih **Spanish:** Milano Cabecigrís
Other common names: Cayenne Kite

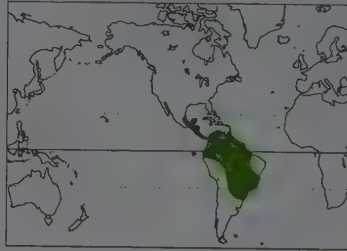
Taxonomy. *Falco cayanensis* Latham, 1790, Cayenne.

Apparent affinity with old world honey-buzzards (*Pernis*) and bazas (*Aviceda*). In past, alternatively known as *Odontriorchis palliatus*. Until recently considered to include *L. forbesi*, which was thought to represent another variant on immature plumage of present species. Two subspecies recognized.

Subspecies and Distribution.

L. c. cayanensis (Latham, 1790) - S Tamaulipas and Oaxaca (Mexico) S to W Ecuador, Amazonia, Guianas and Trinidad.

L. c. monachus (Vieillot, 1817) - C Brazil to E Bolivia, N Argentina and Paraguay.



Descriptive notes. 46-54 cm; 416-605 g. Short, broad wings and long tail. Grey head, black back, tail black with three whitish bars (uppermost concealed) and white tip. Below white with slight greyish wash; black underwing-coverts contrast sharply with generally pale underside of remiges. Iris blue-grey to blue-black; cere, facial skin and legs blue-grey. Sexes alike, but female averages slightly larger. Three distinct immature colour morphs: pale morph all white below (including underwing-coverts) and on head, (including forehead and area above eye) with narrow black cap and nape, broad white collar, dark

brown or blackish back, and brownish bars on tail, recalling much larger adult of *Spizastur melanoleucus*; dark morph similar, but has all dark head, and heavy dark streaking ventrally; intermediate morph lacks white on sides of head and collar, and is whitish ventrally with narrow streaking on breast; cere, facial skin and legs yellow in all immature morphs. Race *monachus* somewhat larger.

Habitat. Rain forest up to 2000 m, but mainly in lowlands, especially in vicinity of water. Regularly soars over the forest, but not for extended periods. Uses gallery forest, forest edge and disturbed, fragmented habitat.

Food and Feeding. A broad diet, including many insects, honeycomb, wasps and hornets and their larvae, birds and their eggs, snakes, lizards (especially arboreal geckos), frogs and molluscs. Often hunts from an exposed perch, especially in early morning or late evening. Observed feeding in association with marmosets in Minas Gerais, Brazil, catching cicadas flushed by the monkeys.

Breeding. Display flight involves rapid, fluttering, downward wingbeats. Two clutches (of 2 and 3 eggs) purportedly of this species. One from twig nest high in tree: eggs greyish white, with reddish brown scrawls and dots. Two unmarked eggs from Trinidad.

Movements. Apparently sedentary.

Status and Conservation. Not globally threatened. CITES II. Rare to uncommon throughout extensive range, but not threatened at present. Estimated average density of at least 3 individuals/10,000 ha at one forest site in French Guiana. In Colombia, commonest in Amazonian zone. Does not persist in heavily cleared areas.

Bibliography. Albuquerque (1986), Belton (1984), Blake (1977), Brodkorb (1943), Contreras *et al.* (1990), Ferrari (1990), Foster (1971), Haverschmidt (1962), Herklots (1961), Hilty & Brown (1986), Meyer de Schauensee & Phelps (1978), Monroe (1968), de la Peña (1992), Pinto (1964), Ridgely & Gwynne (1989), Sick (1985a, 1993), Slud (1964), Stiles & Skutch (1989), Thiollay (1985c, 1989a, 1989b, 1991a), Voous (1969), Wetmore (1965).

7. White-collared Kite

Leptodon forbesi

French: Milan de Forbes **German:** Kragenweih **Spanish:** Milano Acolarado

Taxonomy. *Odontriorchis forbesi* Swann, 1922, Pernambuco, Brazil.

Until recently considered a variant immature plumage of *L. cayanensis*, but specimens of both adult and immature birds collected in Alagoas (NE Brazil) fit type description and confirm validity of the species. Monotypic.

Distribution. NE Brazil: until recently, only known from Pernambuco; recently rediscovered in Alagoas (c. 9° 30' S, 36° W).



Descriptive notes. Male 50 cm, 580 g; female 49 cm, 550 g. A large kite, blackish above, white below; head grey, whiter on hindneck; tail black with broad median band and tips ashy white; mantle spotted and secondaries broadly tipped white; white underwing-coverts. Differs from *L. cayanensis* in whitish collar, different tail pattern, spotted mantle and white underwing-coverts.

Habitat. Atlantic coastal rain forest of NE Brazil.

Food and Feeding. No information available.

Breeding. No information available.

Movements. Presumably sedentary.

Status and Conservation. INSUFFICIENTLY KNOWN CITES II. Not rare locally, but has very limited range, continuing destruction of its forest habitat, which has now been reduced to 1% of its former extent. Combination of these two factors must place this amongst the most endangered raptors in the world.

Bibliography. Brown & Amadon (1968), Collar *et al.* (1992), Forrester (1993), Pinto (1964), Rusch (1979), Sick (1985a, 1993), Teixeira *et al.* (1987a, 1987b).

Genus *CHONDROHIERAX* Lesson, 1843

8. Hook-billed Kite

Chondrohierax uncinatus

French: Milan bec-en-croc German: Langschnabelweih Spanish: Milano Picogarrio

Taxonomy. *Falco uncinatus* Temminck, 1822, Bahia, Brazil.

Large-billed forms have been suggested to form a separate species (*C. megarhynchus*), but this view now discredited; race *wilsonii* of Cuba also recognized by some as full species. Mexican birds traditionally awarded separate race, *aquilonis*, but considerable individual variation (both in Mexico and elsewhere) indicates that subspecific status is not merited. Three subspecies recognized.

Subspecies and Distribution.

C. u. uncinatus (Temminck, 1822) - W Mexico (Sinaloa) and extreme S USA (S Texas) S through Central America, Trinidad, the Guianas and Brazil to E Peru and E Bolivia, Paraguay and N Argentina.

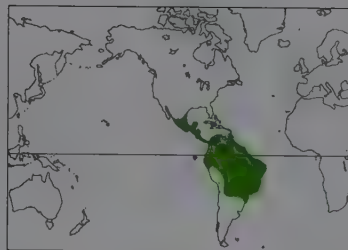
C. u. mirus Friedmann, 1934 - Grenada (Lesser Antilles).

C. u. wilsonii (Cassin, 1847) - E Cuba.

Descriptive notes. 38-42 cm; male 253 g, female 255-360 g. Very large, heavy, hooked bill. Extreme variation in bill size and plumage. Sexual, age-related and individual differences in plumage remarkable, including melanistic morph. Male usually bluish slate above, with grey breast finely barred white or buff, and 2-3 bands in tail; female brown above, with sides of head grey, rusty nuchal collar and rusty to brown breast finely barred white. Variation in bill size is not geographical, but bimodally distributed in many parts of range: large-billed individuals (with bill more than twice size of small-billed ones) found in all age and sex classes. Eye varies from white to pale green to bluish grey; cere greenish yellow, legs orange yellow. Immature dark brown above, creamy white below, with white nuchal collar and 4-5 bands in tail; melanistic juvenile all black with whitish bars in tail. Island forms somewhat smaller: race *mirus* shows some plumage differences; *wilsonii* has all yellowish bill.

Habitat. Rain forest, in lower canopy and dense understorey, forest edge, clearings and disturbed forest; low (5 m) xeric forest on Grenada; acacia thorn-scrub woodland in Mexico; both upland tall forest and seasonally flooded low-lying forests in Petén, Guatemala. Regularly soars over the forest.

Food and Feeding. Mostly tree snails, but also some reptiles, frogs, salamanders, freshwater crabs, and insects ("many caterpillars"). Lizards represented 8% of prey items in Petén. Snails extracted



from their shells in stereotyped manner: bird breaks inner whorls by forcing upper mandible towards apex of shell's spire, a method very different from that used by *Rostrihamus*. Island forms, with only one size of snail available, do not exhibit dimorphism in bill size; continental forms, with pronounced dimorphism in bill size, prey on different species and size classes of snails. Regularly catches food by perch-hunting, or by hopping about between branches.

Breeding. Birds in breeding condition Mar-Apr. in NE Colombia; in Surinam, nest building in Oct, laying late Nov, nest with young

in Apr; in Petén (Guatemala), laying late in dry season (Jun-Jul), after most other raptors in the area have already fledged young. Probable courtship display on Grenada included birds circling together, diving at each other and calling frequently. Stick nest lined with twigs, built by both sexes 5-7 m up in tree (Mexico), or average 25 m up (Petén), c. 5 m from top of nest tree; often placed precariously on thin branches far from main trunk; nest shallow and very small, so that both head and tail of incubating adult extend well beyond edge. 1-2 eggs; incubation c. 35 days, shared by male; male brings most food to nest, and occasionally feeds young; fledging in early to middle rainy season, presumably to take advantage of more plentiful tree snails when the other two sympatric breeding kites, *Elanoides* and *Ictinia plumbea*, are beginning to migrate S.

Movements. Presumably sedentary; no movements recorded.

Status and Conservation. Not globally threatened. CITES II: race *wilsonii* on CITES I. Widespread but unobtrusive, and generally appears to be uncommon. Has colonized S Texas in fairly recent times, with 10-20 pairs by mid-1980's. Race *mirus* of Grenada seriously endangered, currently numbering only 15-30 individuals, although this represents an increase over a 1982 survey; decline due to habitat loss and introduced snails, which are probably too large for present species to deal with, but which feed on the native snails upon which it depends. Total population of race *wilsonii* of Cuba greatly reduced, and probably now restricted to E part of the island.

Bibliography. Amadon (1960, 1964), Blake (1977), Blockstein (1988), Contreras *et al.* (1990), Delnicki (1978), Fjeldså & Krabbe (1990), Fleetwood & Hamilton (1967), Friedmann (1934), Garrido (1985), Haverschmidt (1962, 1964), Hilty & Brown (1986), King (1978/79), Lowery & Dalquest (1951), Marroquín *et al.* (1992), Meyer de Schauensee & Phelps (1978), Monroe (1968), Montiel de la Garza & Contreras-Balderas (1990), Orjans & Paulson (1969), Palmer (1988), de la Peña (1992), Pinto (1964), Ridgely & Gwynne (1989), Sick (1985a, 1993), Slud (1964), Smith (1982), Smith & Temple (1982a, 1982b), Stiles & Skuich (1989), Sykes (1987), Thiollay (1989a, 1989b, 1991a, 1993b), Voous (1969), Wetmore (1965), Wiley (1985, 1986), Wotzkow (1985).



9



10



typical morph



dark morph



pale morph



ssp philippensis



ssp orientalis



12

ssp ruficollis

ssp torquatus
normal morph



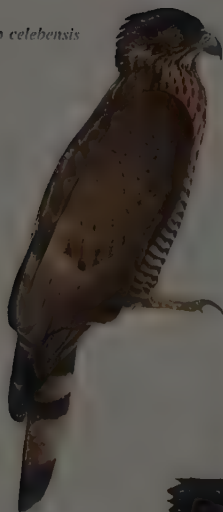
ssp ptilorhynchus



ssp torquatus
dark morph



ssp palawanensis



ssp celebensis



ssp steerei



14



15



16

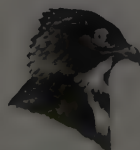


ssp alcinus

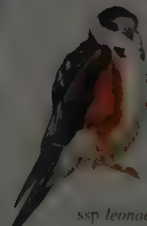
ssp anderssoni



ssp papuanus



ssp swainsonii



ssp leonae

18

PLATE 4

inches

12

cm

30

Genus *HENICOPERNIS* G. R. Gray, 1859

9. Long-tailed Buzzard

Henicopernis longicauda

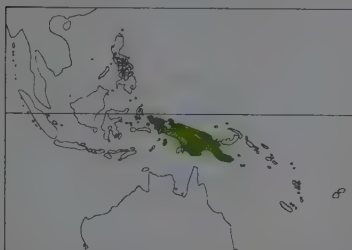
French: Bondrée à longue queue **German:** Langschwanzweih
Other common names: Long-tailed Honey-Buzzard

Spanish: Abejero Colilargo

Taxonomy. *Falco longicauda* Garnot, 1828, New Guinea.

Genus traditionally considered close to *Pernis*, but now considered part of endemic Australasian clade, related to old endemic Australian genera such as *Lophoictinia* (see page 55). Has been considered a race of *H. infuscatus*, with which it forms superspecies; separated by plumage. Two races formerly recognized: barely distinct *fraterculus* of Japan I; and smaller *minus* of Aru and W Papuan Is; but now considered invalid, because size varies clinally with altitude in mainland New Guinea, with birds smaller in coastal lowlands, larger in highlands. Monotypic.

Distribution. New Guinea, W Papuan islands, Aru Is.



Descriptive notes. 50-60 cm; male 447-630 g, larger female 570-730 g. Superficially similar to *Pernis*, but bill, face and feet more like *Lophoictinia*. Similar to *H. infuscatus*, but more mottled, barred and streaked; ventrally paler. Juvenile has extra (narrow) pale band through primaries and tail tip.

Habitat. Tropical rain forest, forest edge, and adjacent clearings, from sea-level to 3000 m. Nests in forest.

Food and Feeding. Mostly insects, including wasps and their larvae; also arboreal lizards, small birds and the contents of their nests, and small mammals. Forages by low, slow harrier.

like quartering close to forest canopy, or between tree trunks, and along the face of steep hillsides in open areas; also flies slowly between perches within forest, peering about. Hawks flying insects low over forest; one bird seen to seize terrestrial prey in adjacent grassland and return to forest.

Breeding. Breeding behaviour occurs from late wet season through dry season (austral autumn to spring); laying recorded May and Aug, active nest Apr-May, nestling May. Solitary. Nest of sticks usually built in tall tree (*Araucaria*, *Planchonella*, *Pandanus*), sometimes as low as 7 m; occasionally on cliff ledge. Clutch size unknown; one record of single nestling. No further information available.

Movements. Adults presumably sedentary, as inferred from geographical variation; no records outside normal range.

Status and Conservation. Not globally threatened. CITES II. Fairly common and widespread throughout New Guinea, but subject to hunting and deforestation and becoming scarce in some areas; population trend and biology poorly known.

Bibliography. Andrew (1992), Beehler (1978), Beehler *et al.* (1986), Bell (1971), Coates (1985), Diamond (1972), Gilliard & LeCroy (1967a), Majne & Bulmer (1977), Mayr & Gilliard (1954), Rand & Gilliard (1967), Rupley (1964), Schodde (1993).

10. New Britain Buzzard

Henicopernis infuscatus

French: Bondrée noire **German:** Bismarckweih
Other common names: Black/New Britain Honey-Buzzard

Spanish: Abejero Negro

Taxonomy. *Henicopernis infuscatus* Gurney, 1882, Blanche Bay, New Britain.

Forms superspecies with *H. longicauda*, of which it has been considered a race; now assigned full species rank in recognition of its distinct plumage. Like *H. longicauda*, now considered to form part of old Australian clade (see page 55). Monotypic.

Distribution. New Britain.



Descriptive notes. 50 cm. Slightly smaller and much darker, less barred or streaked than *H. longicauda*, particularly on underparts. Juvenile unknown.

Habitat. Primary and partly disturbed lowland and hill tropical rain forest.

Food and Feeding. Lizards and spiders in stomachs of specimens; no field observations of feeding. Seen soaring over forest and gliding just above tree canopy; also a bird near ground within forest clambered up leaning trunk to subcanopy. One bird made long, powerful glide over forest canopy.

Breeding. Specimens in breeding condition in

May; no further information.

Movements. No information available. Presumably sedentary, as inferred from isolation, morphology, and lack of records outside normal range.

Status and Conservation. INDETERMINATE. CITES II. Seldom seen by ornithologists, biology unknown. Range, and therefore total population, small and subject to deforestation in lowlands.

Bibliography. Amadon & Bull (1988), Bishop (1983), Brown & Amadon (1968), Coates (1985), Collar & Andrew (1988), Schodde (1978).

Genus *PERNIS* Cuvier, 1817

11. Western Honey-buzzard

Pernis apivorus

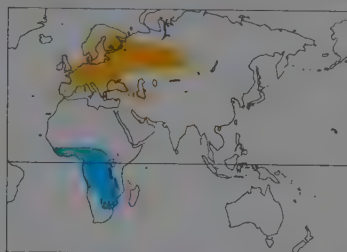
French: Bondrée apivore **German:** Wespenbussard
Other common names: European/Eurasian Honey-buzzard

Spanish: Abejero Europeo

Taxonomy. *Falco apivorus* Linnaeus, 1758, Sweden.

Forms superspecies with *P. ptilorhynchus*, with which sometimes considered conspecific. Monotypic.

Distribution. Europe and W Asia, from Spain, France, SE England and E Scandinavia through W Russia and Caucasus to R Ob in SW Siberia. Winters mostly in Africa S of Sahara.



Descriptive notes. 52-60 cm; 440-1050 g; wingspan 130-150 cm. Polymorphic, with extremely variable coloration. Differs from true buzzards of genus *Buteo* in small head (resembling dove or cuckoo), slender bill, thin neck, longer tail and yellow iris. In flight, often shows black carpal patches on underwing; two dark bands at base of tail. Male normally has grey head; female generally darker, with brown head. Juvenile lacks well defined dark edging to wings; secondaries normally dark, breast often streaked dark; eyes brown; narrow, inconspicuous bars (normally 4) on tail.

Habitat. Forests and woods, preferably deciduous, in temperate and boreal zones; also varied habitats with both wooded and open areas. Normally at low or medium altitudes, but reaching almost 2000 m in mountainous areas (Caucasus, Pyrenees). Winters in Africa, in forests and other densely wooded areas.

Food and Feeding. Mainly wasps and hornets (Hymenoptera), feeding on larvae, pupae and adults; some other insects, including bumble-bees, beetles, Orthoptera, etc. Also takes small vertebrates, e.g. frogs, reptiles (lizards, slow-worms) and chicks and eggs of small and medium-sized birds. Follows wasps in flight to locate their nests; watches them from perch, sometimes catching them in the air. Will remove wasps' nests from trees and dig out ground nests with claws; chunks of "chewed" wasp comb frequently found near nests. Diet in Africa poorly known, but includes Hymenoptera, flying termites and Orthoptera.

Breeding. Laying Jun-Jul. Solitary. Nest is platform of twigs lined with fresh leaves, which are renewed throughout nesting period; nests in woods, preferring deciduous trees. Average 2 eggs (1-3), with laying interval of 3-5 days; incubation 30-35 days per egg, shared by both parents; chicks have long, buffy grey first down, shorter white second down; brooded continuously, mainly by female, at least during first week; both adults bring food to nest and feed chicks; fledging 40-44 days; young receive food from adults for at least 1 month more. Success in Germany, 0.1-1.1 chicks per attempt; heavily affected by fluctuations in food supply and weather. Oldest recorded bird 29 years old.

Movements. Migratory, wintering mainly in equatorial Africa. Leaves breeding zones in Aug-Sept, returning from Apr to early Jun. Gathers in large numbers at favoured crossing points; most birds from W & C Europe cross Straits of Gibraltar; E European birds cross Bosphorus, or follow route to E of Black Sea, passing from Asia to Africa across Gulf of Suez; much smaller numbers fly over Sicilian Channel.

Status and Conservation. Not globally threatened. CITES II. Population apparently stable, although some regional fluctuations. World population very high, presumably at least in hundreds of thousands of pairs, given spectacular numbers counted during migration: 851,598 birds in spring 1985 at Elat (Israel); and 117,175 at Gibraltar in autumn 1972. Precise counts in breeding zones difficult to carry out, but estimates in early 1990's include: 100,000 pairs in European Russia; 900-1700 pairs in Byelorussia; c. 200 pairs in Bulgaria; and 1500 pairs in Austria. In 1980's: 8000-12,000 pairs in France; 400-500 pairs in Netherlands; 800-1000 pairs in Denmark; c. 8000 pairs in Sweden; c. 5000 pairs in Finland; c.600 pairs in Czechoslovakia; and c. 1500-2000 pairs in Poland. This healthy status is possible because the insects on which present species feeds have not been heavily affected by insecticides. Large numbers of birds still shot during migration in some areas, most notoriously in Italy and on Malta.

Bibliography. Agostini (1992), Brown *et al.* (1982), Cramp & Simmons (1980), Dementiev & Gladkov (1951), Divyabhusin (1990), Flint *et al.* (1984), Gómsbol (1986), Ginn *et al.* (1989), Glutz von Blotzheim *et al.* (1971), Goodman *et al.* (1989), Grimes (1987), Handrinos & Demetropoulos (1983), Holstein (1944), Kjellen (1992), Kosirzowa (1985, 1986, 1987, 1989, 1991), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Martin, B.P. (1992), Moreau (1972), Olech (1991), Paz (1987), Pickford *et al.* (1989), Pinto (1983), Rasmussen & Storgard (1989), Schubert (1977), Shirahai & Christie (1992), Simeonov *et al.* (1990), Stresemann (1940b), Thiollay (1989c), Tree (1973).

12. Crested Honey-buzzard

Pernis ptilorhynchus

French: Bondrée orientale **German:** Schopfweidenbussard
Other common names: Oriental/Eastern Honey-buzzard

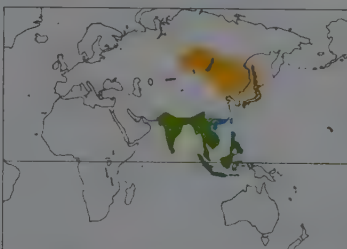
Spanish: Abejero Oriental

Taxonomy. *Falco ptilorhynchus* Temminck, 1821, Java.

Forms superspecies with *P. apivorus*, in which sometimes included. All listed races may be close to species threshold. Other doubtful races not generally accepted include *japonicus*, *neglectus* and *gurneyi*, described respectively from Japan, Taiwan and Burma. Emendation of original spelling to *ptilorhynchus* is not justified. Six subspecies normally recognized.

Subspecies and Distribution.

P. p. orientalis Taczanowski, 1891 - S Siberia E to Amurland and Sakhalin, S to Manchuria, Japan and possibly Korea; winters S to SE Asia, Indonesia and Philippines.
P. p. ruficollis Lesson, 1830 - India and Sri Lanka E through Burma to SC China (Yunnan).
P. p. philippensis Mayr, 1939 - N & E Philippines.
P. p. palawanensis Stresemann, 1940 - Palawan and Calauit (W Philippines).
P. p. torquatus Lesson, 1831 - Malay Peninsula, Sumatra and Borneo.
P. p. ptilorhynchus (Temminck, 1821) - Java.



Descriptive notes. 52-68 cm; 750-1490 g; wingspan 135-150 cm. Polymorphic, with extremely variable coloration. Similar to *P. apivorus*, but larger; often has well developed nuchal crest and sometimes dark horseshoe-shaped spot on crop. Races separated mainly by coloration, size and development of crest.

Habitat. Wooded areas, preferring broad-leaved trees, in wide variety of biomes ranging from tropical forests to taiga. Dense forests, open wooded areas or mixed woodland and open areas. Lowlands, hills and lower and middle slopes of mountains, up to 1800 m in Himalayas and 1500 m in Japan.

Food and Feeding. Mainly bees and wasps, in particular their larvae, also eating bits of comb and honey; feeds on nests in tree holes and similarly on those hanging from branches. Also takes other

insects, e.g. crickets, flying termites and ants; occasionally vertebrates, including lizards, frogs, small mammals and birds. Can dig in ground to expose insect nests, subsequently eating larvae. Spends long periods scanning from perch.

Breeding. Laying starts Feb in S India; May and particularly Jun in N of range. Nests mainly in broad-leaved trees, but also in conifers and even coconut palms; sometimes at considerable height, up to 28 m above ground. Nest built in fork of tree; platform of twigs lined with leaves and other light material, c. 40 cm wide, 20 cm deep; built by both adults. Normally 2 eggs; incubation 28-35 days; by both adults; both also feed chicks; fledging 35-45 days.

Movements. Migratory in N populations, sedentary or with local movements in S. Arrives on breeding grounds in Siberia and Japan in May; leaves in Sept/Oct to winter from SE Asia S to Indonesia, where migrants may coincide with sedentary populations. Considerable movement recorded over Bali, with 2186 birds seen in 1 month, mainly from mid-Oct to early Nov. The late spring migration is related to availability of food in N breeding zones; arrival in some areas of the Punjab in Pakistan coincides with that of migratory rock bee (*Apis dorsata*). May travel long distances in search of feeding areas, e.g. on Indian Subcontinent. Recent records from Andaman Is may refer to migrants or perhaps to local breeding population.

Status and Conservation. Not globally threatened. CITES II. Status poorly known; retiring habits of species make its detection difficult. Rare or uncommon in most of N breeding zones, but more common in USSR/land; uncommon and local in Japan. In some areas of Pakistan, species has colonized irrigated forest plantations.

Bibliography. Ali & Ripley (1978), Ash (1993), Austin (1948), Bogorobskii (1988), Brazil (1991), Brazil & Hanawa (1991), Cheng Tso-hin (1987), Deignan (1945), Dementiev & Gladkov (1951), Dickinson *et al.* (1991), Divyabhanushin (1990), Eichécor & Húe (1978), Flint *et al.* (1984), González (1983), Hou *et al.* (1990), Inskipp & Inskipp (1985), Knystautas (1993), Lekagul & Round (1991), MacKinnon (1988), MacKinnon & Philipps (1993), van Marle & Voous (1988), Medway & Wells (1976), Meyer de Schauensee (1984), Parkes (1971), Prakash *et al.* (1993), Roberts (1991), de Roder (1989), Rogacheva (1992), Smythies (1981, 1986), Wilkinson *et al.* (1991a, 1991b).

13. Barred Honey-buzzard

Pernis celebensis

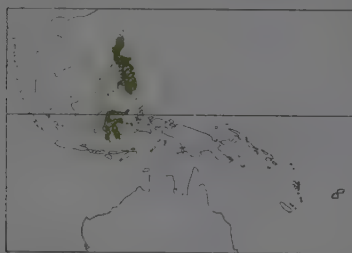
French: Bondrée des Célèbes **German:** Celebeswespenbussard **Spanish:** Abejero de Célebes

Taxonomy. *Pernis cristatus* var. *celebensis* Wallace, 1868, Sulawesi.
Two subspecies recognized.

Subspecies and Distribution.

P. c. celebensis Wallace, 1868 - Sulawesi, Muna I and Banggai Is.

P. c. steerei W. L. Slater, 1919 - Philippines (except Palawan).



Descriptive notes. 51-56 cm. Typical honey-buzzard, with flat talons and lacking supraorbital ridge. Bold barring on underparts; crest short (*steerei*) or lacking (*celebensis*). Plumage very similar to that of sympatric *Spizaetus lanceolatus* on Sulawesi; in contrast, in Philippines, sympatric *Spizaetus philippensis* is less similar. Juvenile paler and less heavily marked. Race *steerei* separated by short crest and less boldly barred belly.

Habitat. Primary forest and forest edge from sea-level up to 1800 m; perhaps at lower levels than sympatric *P. ptilorhynchus* in Philippines.

Food and Feeding. Little studied. Typical

honey-buzzard, feeding on Hymenoptera and honey combs; also birds. Flies through and below canopy from one open perch to another, searching for flying insects which may lead it to their nests.

Breeding. Poorly known. One record of nesting in Feb in Philippines; in Sulawesi, one clutch in May, one female ready to lay in Sept. Display flight involves claw-grasping. Single clutch known of 2 eggs. No further information available.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES II. Status poorly known; reported to be widespread but generally uncommon in Sulawesi, and uncommon in Philippines; apparently not uncommon in some parts of Sulawesi. Long-term threat is loss of forest habitat, especially in Philippines. Extensive research required; surveys also desirable.

Bibliography. Andrew (1992), van Bommel & Voous (1951), Bishop *et al.* (1994), Brown & Amadon (1968), Dickinson, Kennedy & Parkes (1991), Dickinson, Kennedy *et al.* (1989), Rand & Rabor (1960), Stresemann (1940a), White & Bruce (1986).

Genus LOPHOICTINIA Kaup, 1847

14. Square-tailed Kite

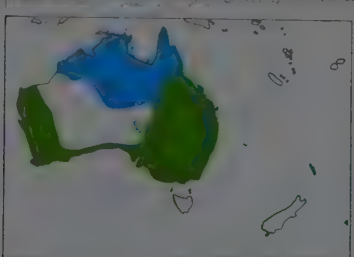
Lophoictinia isura

French: Milan à queue carrée **German:** Schopfmilan **Spanish:** Milano Colicudrado
Other common names: Long-winged Kite

Taxonomy. *Milvus isurus* Gould, 1838, New South Wales.

Has been regarded as related to *Milvus*, but resemblance superficial and convergent; now considered part of old endemic Australasian clade (see page 55). Monotypic.

Distribution. Australia breeding mainly in W, S & E, but also occupying N in non-breeding season.



Descriptive notes. 50-56 cm; 501-680 g; wingspan 131-145 cm. Slender, long-winged hawk superficially resembling *Milvus milvus*, but with square or slightly notched tail tip. Distinguished from related *Hamirostra* by slighter build, narrower wings and long tail. Female larger and heavier. Juvenile has rufous head; lacks white face and heavy streaking.

Habitat. Open forest, woodland and edge, less often scrub, heath, grassland, farmland and urban fringe; from sea-level to 1000 m. Avoids treeless, arid and alpine areas. Nests in forest and woodland, often in riparian situations.

Food and Feeding. Mostly small birds, and particularly their eggs and nestlings, often honeyeaters (Meliphagidae) and other passerines that build nests in foliage. Also insects, reptiles, tree-frogs and rarely small mammals; not carrion. Foraging is

solitary and entirely aerial by low, slow quartering of tree and shrub canopy; also hawks flying insects. Drops suddenly to snatch prey from foliage or seize prey startled into flight; reaches into, tears apart, or removes, nests; rarely alights on ground.

Breeding. Jul-Dec. Solitary, but sometimes near raptors of other species. Nest is platform of sticks 50-85 cm wide, 25-60 cm deep, lined with green leaves; placed 8-34 m above ground in forks of living trees. Usually 3 eggs (2-3); incubation c. 37-42 days; chicks have white down; fledging c. 59-65 days; post-fledging dependence over 1 month. Sexual maturity apparently at 2 years old, but rarely breeds in immature (2nd year) plumage. Broods of 1 or 2 young fledge; some brood reduction in nest through starvation, and storms blow nests down. Success of 1-3 young per year for one pair over 7 years; another pair consistently failed over 15 years, because eggs regularly collected.

Movements. Spring breeding migrant in S, non-breeding migrant to N Australia in dry season (austral winter); some breeding birds resident in SW and coastal E Australia, but these expand home ranges or make local movements in winter. Movement diffuse, without flocking or major concentration points, but individuals may follow ridge systems or rivers.

Status and Conservation. Not globally threatened. CITES II. This highly specialized raptor is uncommon and declining, subject to habitat clearance and illegal egg-collecting in its S and E breeding range; may be threatened. Has low breeding density and recruitment rate. Population estimated at 20-50 pairs in Victoria; under 10 birds in South Australia, where few recent successful breeding records. Recently adapting to well vegetated outer fringes of cities in subtropical E Australia, where it feeds on abundant exotic and native passerines. Eggshell thickness not significantly reduced by DDT.

Bibliography. Binns *et al.* (1991), Cameron (1976, 1992), Cupper & Cupper (1981), Debus (1991a, 1993a), Debus & Czechura (1989, 1992a), Debus & Silveira (1989), Debus, Earle *et al.* (1992), Debus, McAllan & Morris (1993), Fraser (1993), Garnett (1992), Hollands (1984), Johnston (1983), Marchant & Higgins (1993), Olsen (1991), Olsen & Marples (1993), Olsen, Crome & Olsen (1993), Schodde (1993), Schodde & Tidemann (1988), Schulz (1983).

Genus HAMIROSTRA T. Brown, 1846

15. Black-breasted Buzzard

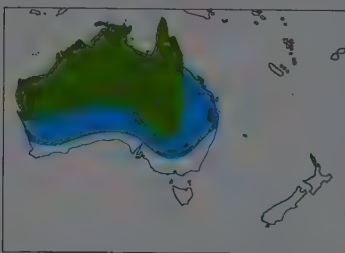
Hamirostra melanosternon

French: Milan à plastron **German:** Schwarzbrustmilan **Spanish:** Milano Pechinegro
Other common names: Black-breasted Kite/Buzzard-kite

Taxonomy. *Buteo melanosternon* Gould, 1841, interior of New South Wales.

Traditionally regarded as a primitive kite of *Milvus* affinity, to which unrelated; now considered part of old endemic Australasian clade (see page 55). Monotypic.

Distribution. Australia, except S and E.



Descriptive notes. 51-61 cm; 1150-1450 g; wingspan 147-156 cm. Adult, with mostly black body, short tail and white patches in wings, unmistakable. Distinguished from related *Lophoictinia* by heavy build, larger bill and feet, and shorter tail. Alleged "pale morph" has recently been shown to be second immature plumage, adopted in the bird's third or fourth year. Female larger and heavier than male. Juvenile rufous, streaked black.

Habitat. Woodland, savanna, plains and deserts of tropical N and arid C Australia; from sea-level to at least 500 m; avoids forest. Nests in woodland.

Food and Feeding. Mammals, birds, reptiles, carrion, and occasionally large insects; prefers young rabbits, bird nestlings (including those of other raptors) and eggs, and large lizards. Forages by fast gliding transects at moderate height, and also by low, slow quartering and high soaring; sometimes walks on ground, searching. Swoops to snatch prey from trees or seize it on ground. Breaks eggs of large ground-nesting birds with blows of bill, or uses bill to hurl stones at them from standing position on ground.

Breeding. Jun-Nov, usually Aug-Oct. Solitary, but sometimes nests near raptors of other species; usually monogamous but one record of polyandrous trio persisting over 4 years. Nest is platform of sticks 70-120 cm wide, 40-55 cm deep, lined with green leaves; placed 6-22 m above ground in forks of living or dead tree. Usually 2 eggs (1-2, rarely 3); incubation c. 36-40 days; chicks have white down; fledging c. 60 days; post-fledging dependence at least 2 months. Sexual maturity at 2 years or older; occasionally breeds in immature (2nd or 3rd year) plumage. Usually 1 young fledges (1-2); nest success 62%, or 1-3 young per successful nest, and 1-1 per nest started; 0.76 young per pair per year.

Movements. Poorly understood; apparently some resident and some migratory populations. Breeding birds sedentary in C Australia unless forced to move by drought; dry season (austral winter and spring) breeding migrant to N Australia, withdrawing from tropical coasts in wet season; avoids CW Australia in summer. Occasional minor irruptions to S and E parts of range during inland drought.

Status and Conservation. Not globally threatened. CITES II. Has conservation status of concern. Generally uncommon and has declined in SE of range through habitat clearance and poisoning of carcasses on which it scavenges; habitat degraded and some prey mammals extinct in SE and SC Australia, but may have benefited from introduced rabbit and abundance of stock carrion. Low breeding density and recruitment rate; sensitive to human activity near nest. Sometimes killed when scavenging on roads; subject to illegal egg-collecting.

Bibliography. Angus (1992), Aumann (1990a), Baker-Gabb (1990), Cupper (1977), Cupper & Cupper (1981), Debus (1991b), Debus & Czechura (1992b), Garnett (1992), Hollands (1984), Marchant & Higgins (1993), Olsen (1991), Olsen & Marples (1993), Olsen, Crome & Olsen (1993), Pepper-Edwards & Norley (1991a, 1991b), Schodde (1993), Schodde & Tidemann (1988).

Genus ELANOIDES Vieillot, 1818

16. American Swallow-tailed Kite

Elanoides forficatus

French: Milan à queue fourchue **German:** Schwalbenweih **Spanish:** Elanio Tijereta
Other common names: Swallow-tailed Kite

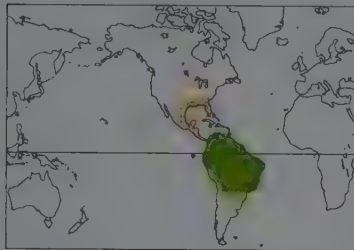
Taxonomy. *Falco forficatus* Linnaeus, 1758, America = Carolina.

Not clearly or closely related to any other genus, but some similarities with *Elanus* and the *Pernis* group. Two subspecies recognized.

Subspecies and Distribution.

E. f. forficatus (Linnaeus, 1758) - coastal SE USA to N Mexico.

E. f. yelapa (Vieillot, 1818) - S Mexico (except Yucatán) S through Central America (excluding El Salvador) to E Bolivia, Paraguay and NE Argentina (Misiones).



Descriptive notes. 56-66 cm; 375 g; wingspan 130 cm. Unmistakable, with long, pointed wings and long, deeply forked tail. Above black, with bluish purple sheen; head, neck and underside, including underwing-coverts, pure white; flight-feathers and tail black. Iris dark brown to reddish. Immature generally similar to adult, but tail less deeply forked. Race *yelapa* has greenish sheen on upperparts.

Habitat. Primarily over forests in tropical and subtropical zones, perhaps higher; sometimes shows certain preference for swampy areas and marshes.

Food and Feeding. Insects, often feeding on insect swarms or hatches, e.g. of *Atta sexdens*; paperwasp nest delivered to young in nest. Also takes small vertebrates, including a bat and a small snake; frogs can be important; in Florida (USA) c. 99% of prey delivered to nest made up of anole lizards. Some fruit (Moraceae, Sapindaceae); in the Petén, Guatemala, fruit rarely delivered to nest, but at least one instance at most nests. Takes young birds from nests, carrying off entire nests of smaller species; nestling birds 18% of prey delivered to nests in Petén. Insects taken and consumed on the wing, often high up, but can be gleaned off canopy in low glides; sometimes takes fruit in like manner; also catches hummingbirds, which may be "gleaned" off canopy perches or perhaps as they are hovering at a canopy flower feeding on nectar. Often highly gregarious.

Breeding. Laying in mid-Mar in Florida; season Jan-May/Jun in Costa Rica; Mar in Panama and Colombia. Often several pairs nesting within a few hundred metres. Twig nest, frequently lined with moss, precariously placed in very top of tall trees (under 1 m from top); situated on very small branches, which probably reduces chance of predation by mammals, but avian predation can occur, and nests are not infrequently lost in strong winds; nests not normally reused, but pair recorded using old nest of *Ictinia mississippiensis*, under 100 m from previous year's nest. Copulation often preceded by courtship feeding; unmated male recorded interfering with copulation and courtship of mated pair. Both parents share all aspects of rearing brood, from incubation to feeding, although females do more at nest, males spend more time providing food. Usually 1-2 eggs (average 1.83 in Petén, higher in USA), but up to 3 in USA; incubation from c. 28 days (USA) to 31 days (Petén), beginning with first egg, which is significantly larger than the second; fledging c. 40 days in USA, average 52.3 days in Petén. Renesting recorded (Petén). Siblicide in first week reported in all Petén nests where 2 eggs hatched. As many as 6 additional adults seen soaring near an active nest and perched in nest tree, but no evidence of helping to feed young.

Movements. Migratory in N and S of range. In late Jul/early Aug, large concentrations at communal night roosts (over 1300 birds leaving one morning) at Lake Okeechobee, Florida, apparently a staging post prior to southward migration; departs from Petén by end Aug. Arrives in Costa Rica in Jan, all birds disappearing by Jul or early Aug. Arrives in Florida in Mar, in Petén in early Feb. Birds ringed in USA have been shot while wintering in S and SE Brazil. Over most of South American range, unclear where species is resident and where only migrant, as very few breeding records; birds in breeding condition in SE Colombia (Vaupés), but otherwise most of Colombian birds may be migrants. In Amazonia, only one nest reported on upper R Negro, Brazil, although species doubtless breeds in the region. Nomadic at least in parts of South America over rain forest. Wanders to 2600 m in Andes of Colombia, and recorded at 5000 m near Lima, Peru. Accidental in Bahamas.

Status and Conservation. Not globally threatened. CITES II. Relatively common over much of its extensive distribution. Estimated average density of at least 10 individuals/10,000 ha at one forest site in French Guiana. Formerly occurred further inland in USA, to Oklahoma, Minnesota and North Carolina; probable causes of decline include direct persecution, and possibly habitat transformation, mainly for agriculture; slight recovery since 1950's.

Bibliography. Belton (1984), Benson (1992), Blake (1977), Brisse (1986-1988), Brown, M. (1987), Buskirk & Lechner (1978), Cely (1979, 1987), Cely & Sorrow (1990), Connor & Lofén (1985), Fjeldså & Krabbe (1990), Gerhardt *et al.* (1990, 1991), Haverschmidt (1962), Hilty & Brown (1986), Kilham (1980), Lemke (1979), Meyer de Schauensee & Phelps (1978), Millsap (1987), Monroe (1968), Nugent *et al.* (1989), Olvares & Hernández (1962), Palmer (1988), Parker (1984), de la Peña (1992), Pinto (1964), Ridgely & Gwynne (1989), Russell (1964), Sick (1985a, 1993), Skutch (1967, 1965), Slud (1964), Snyder (1975), Süles & Skutch (1989), Sutton (1955), Terborgh & Weske (1975), Thiollay (1989a, 1989b, 1991a), Voous (1969), Wetmore (1965).

Genus MACHEIRAMPHUS

Bonaparte, 1850

17. Bat Hawk

Macheiramphus alcinus

French: Milan des chauves-souris **German:** Fledermausaar **Spanish:** Milano Murciélaguero
Other common names: Bat Falcon/Pern/Kite, Bat-eating Buzzard/Hawk

Taxonomy. *Macheiramphus alcinus* Bonaparte, 1850, Malacca.

Monotypic genus with affinities uncertain; formerly classified in Falconidae. Genus name often spelt *Macheiramphus*, but *Macheiramphus* has priority. Little known population of Sulawesi might refer to distinct, undescribed race. Three subspecies recognized.

Subspecies and Distribution.

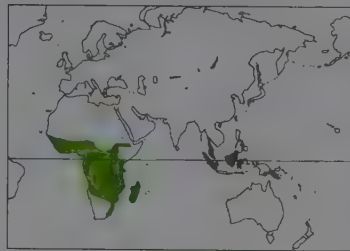
M. a. alcinus Bonaparte, 1850 - S Burma, W Thailand, Malay Peninsula, Sumatra, Borneo and NC Sulawesi.

M. a. papuanus Mayr, 1940 - E New Guinea.

M. a. anderssoni (Gurney, 1866) - Senegambia E to Ethiopia and S to South Africa, Madagascar.

Descriptive notes. 45 cm; 600-650 g. Wide gape and small delicate bill. Yellow eyes, together with white eyelids, throat and occipital spots, all contrast with dark plumage. White on underparts may be completely covered but always present and more extensive in juvenile. Long, pointed wings and tail, barred flight-feathers and protruding carpal joint notable in flight. Races distinguished by darkness of plumage, extent of white on underparts and crest, size and crest length.

Habitat. Most widespread in evergreen forest and dense deciduous woodland, often associated with limestone; extends to drier savanna, where bats and exotic plantations exist, often entering towns. Roosts by day in densely foliated tree.



Food and Feeding. Primarily 20-75 g insectivorous bats; small birds up to size of doves also important, and some large flying insects taken. Captures all prey by fast aerial pursuit from the rear; mainly crepuscular, but hunts throughout night when moonlit. Less commonly soars and hunts during the day. Favours open hunting areas, especially over water and around floodlights. Takes prey in the feet and usually swallows it whole in flight via large gape; even birds dealt with thus, but larger bats and birds may be taken to a perch. Can capture and ingest a single bat in 6 sec, 5 in 5 min, or up to 17 (total

daily requirements) in an evening.

Breeding. Laying probably Apr in Gabon; Mar, Oct-Nov in Sierra Leone; Apr-Jun, Oct in E Africa; Aug-May (peak Sept-Nov) in S Africa; Apr-Jul in Malaysia and Sumatra. Builds substantial platform of sticks, broken off with the feet in flight; favours outer lateral forks on uncluttered branches to facilitate landing. Usually in large light-barked emergent tree, e.g. eucalypts or baobabs, as these are easily visible at night. 1 large egg (rarely 2); incubation 48 days, fledging 67 days, both unusually prolonged; chicks have white down. No obvious sexual size dimorphism or provisioning of female by male; both sexes share incubation, brooding and feeding of chick.

Movements. Generally considered resident in tropics, but renowned in subtropical S Africa for appearing far from normal habitat; described as visitor to parts of NE Africa.

Status and Conservation. Not globally threatened. CITES II. Status difficult to assess due to nocturnal habits and custom of roosting in densely foliated trees; often considered uncommon to rare. Probably at low densities, with home range of c. 450 km² in South Africa. May be declining in Borneo. Apparently more widespread and common in tropical areas, and even in cities. Nests vulnerable to destruction by high winds. Not known to be affected by pesticides although bat prey probably susceptible.

Bibliography. Auburn (1987), Ballance (1981), Bartels (1952), Beehler *et al.* (1986), Benson & Benson (1975), Black *et al.* (1979), Brooke & Clancey (1981), Brown *et al.* (1982), Chapin (1932), Coates (1985), Deignan (1960), Fenton *et al.* (1978), Ginn *et al.* (1989), Grimes (1987), Harris *et al.* (1990), Hartley (1988), Hartley & Husler (1993), Husler (1983b), Kemp & Kemp (1975b), Langrand (1990), Lewis & Pomeroy (1989), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Madoc (1976), van Marle & Voous (1988), Medway & Wells (1976), Milon *et al.* (1973), Milstein *et al.* (1975), Pakenham (1979), Pickford *et al.* (1989), Pinto (1983), Smythies (1981), Steyn (1982), Tarboton & Allan (1984), Thiollay (1978c), Thomson (1975), Vernon (1979).

Genus GAMPSONYX Vigors, 1825

18. Pearl Kite

Gampsonyx swainsonii

French: Élanion perle

German: Perlhaar

Spanish: Elanio Enano

Taxonomy. *Gampsonyx swainsonii* Vigors, 1825, tableland of Bahia, Brazil.

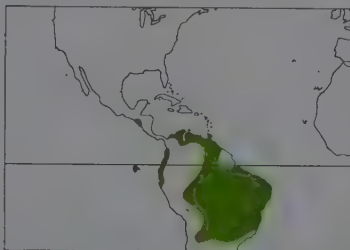
Formerly thought to be a falconid related to *Polihiherax* and *Spizapteryx*, but osteological evidence, scutellation and moult pattern convincingly place it near *Elanus*. Disjunct Nicaraguan population reportedly indistinguishable from South American populations. Three subspecies recognized.

Subspecies and Distribution.

G. s. leonae Chubb, 1918 - Nicaragua; N Colombia through Venezuela and Trinidad to Guyana and Surinam, and S to R Amazon.

G. s. swainsonii Vigors, 1825 - Brazil S of R Amazon to E Peru, E Bolivia, Paraguay and N Argentina.

G. s. magnus Chubb, 1918 - coastal W Colombia, Ecuador and N Peru.



Descriptive notes. 20-28 cm; male 94 g; wing-span 54 cm. Very small and falcon-like. Blackish above, mostly white below with black patch on side of breast and rusty brown thighs; forehead and cheek patches yellowish or orange buff, with inconspicuous white nuchal collar followed by dark rufous band. Trailing edge of wings white. Iris brown, cere black, legs bright yellow. Female slightly larger than male. Immature like adult, but nuchal collar yellowish and back and secondary feathers edged rufous. Races *leonae* and *magnus* both have rufous flanks; *magnus* somewhat larger.

Habitat. Dry to and regions, shrubby pasture, savanna, *cerrado* and open tropical woodland; occurs up to 1000 m in Colombia. Usually nests in sparse woods.

Food and Feeding. Predominantly lizards, which constituted 90% of identified prey items in Trinidad; also large insects, and sometimes small birds. Prey usually taken after a short dive to the ground from a perch.

Breeding. Season variable, perhaps related to rains. Flimsy twig nest built 5 m up at tip of horizontal branch; on Trinidad, nests c. 20 m high in 25 m trees, often supported by vine tangles; nest c. 20 cm wide, 10 cm deep. Male has flutter-glide courtship display flight, sometimes used by female too. Courtship feeding often precedes copulation. 2-3 eggs; incubation mainly by female, period unrecorded; fledging c. 35 days. On Trinidad, a pair successfully reared 2 broods/year in 3 consecutive years, fledging 1-4 young per nesting attempt; nesting timed so that young reach independence at beginning (May) and end of rainy season; courtship sometimes begins only 2 weeks after last young dispersed from previous nesting attempt. Records of incubation in Nov in Colombia and chicks in Apr in Venezuela suggest continental birds too may rear more than 1 brood per pair per year.

Movements. Apparently sedentary. Young birds disperse from natal territory within 12-14 weeks of the initiation of a nesting attempt. First record in Panama in 1977 more likely a bird coming N from South America, rather than a vagrant from Nicaraguan population.

Status and Conservation. Not globally threatened. CITES II. Locally distributed and not generally common, but probably benefits from forest destruction, e.g. numerous in partly deforested areas of S Córdoba (NW Colombia), which may only have been colonized quite recently; the only carefully studied nest was in an extensive suburban housing development. In general, fairly common in suitable habitats in Colombia.

Bibliography. Belton (1984), Blake (1977), Brown & Amadon (1968), Contreras *et al.* (1990), French (1982, 1985), Hilty & Brown (1986), Meyer de Schauensee & Phelps (1978), de la Peña (1992), Pinto (1964), Pujals *et al.* (1977), Ridgely & Gwynne (1989), Robbins *et al.* (1985), Sick (1985a, 1993), Sreetsmann, V (1959).

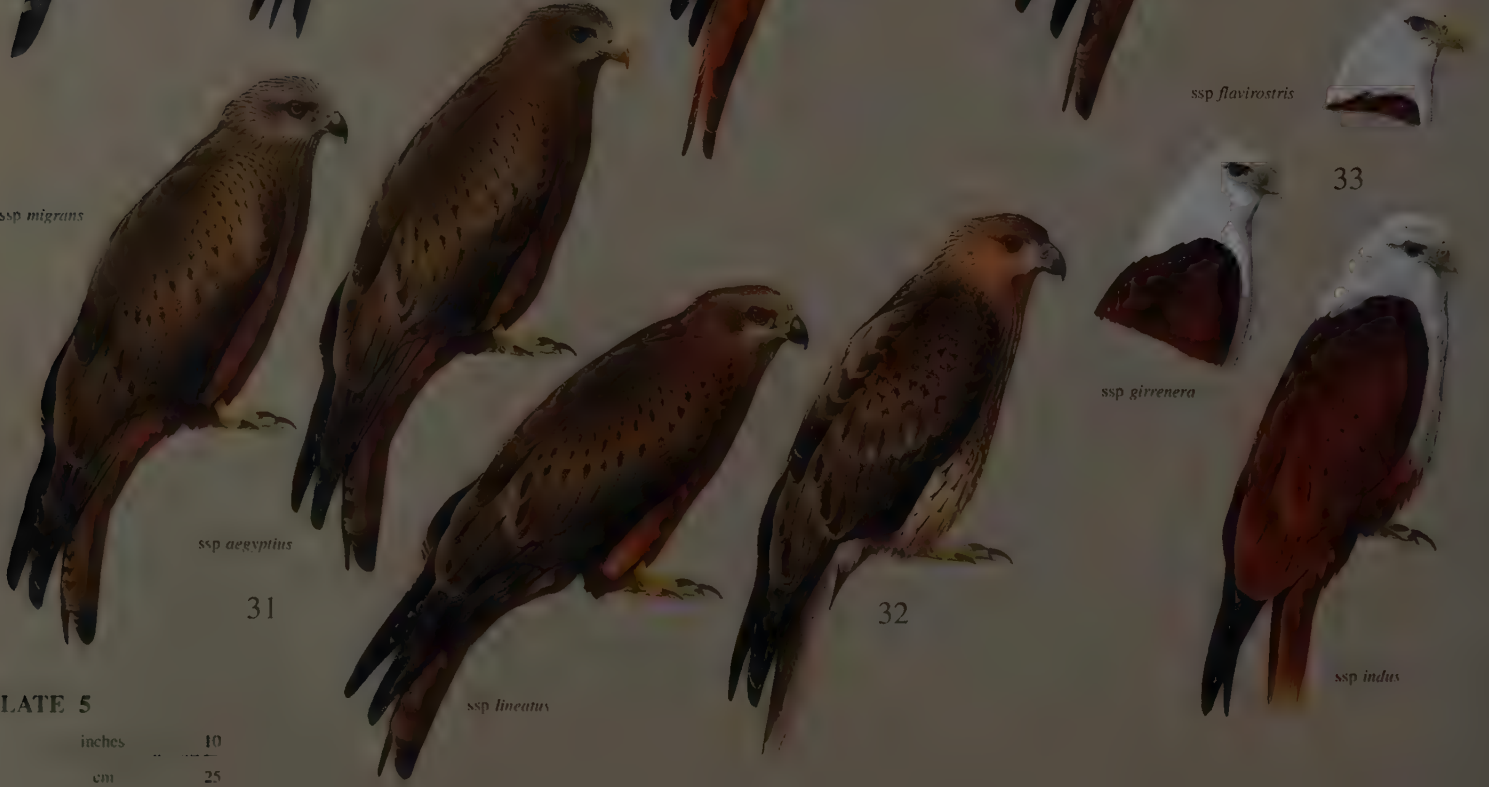
ssp caeruleus



ssp hypoleucus



ssp migrans



ssp aegyptius

ssp girrenera

ssp indus

ssp lineatus

PLATE 5

inches 10
cm 25

Genus *ELANUS* Savigny, 1809

19. Common Black-shouldered Kite

Elanus caeruleus

French: Élanion blanc

German: Gleitaar

Spanish: Elanio Común

Other common names: Black-shouldered/Black-winged Kite

Taxonomy. *Falco caeruleus* Desfontaines, 1789, Algiers.

Forms closely related to *Chelictinia*. Forms superspecies with *E. leucurus* and *E. axillaris*, and all three sometimes considered conspecific. Race *hypoleucus* has been considered separate species. Birds of Sumatra have been awarded separate race, *sumatranus*, but validity doubtful. Four subspecies normally recognized.

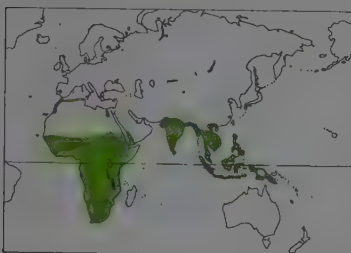
Subspecies and Distribution.

E. c. caeruleus (Desfontaines, 1789) - SW Iberian Peninsula, most of Africa and SW Arabia.

E. c. vociferus (Latham, 1790) - Pakistan E to S & E China, Indochina and Malay Peninsula.

E. c. hypoleucus Gould, 1859 - Sumatra, Java, Borneo, Philippines, Sulawesi, Kalao and Lesser Sundas.

E. c. wahgiensis Mayr & Gilliard, 1954 - New Guinea.



Descriptive notes. 30 cm; male 197-277 g, female 219-343 g; wingspan 84 cm. Distinctive black shoulder patches evident at all ages, when perched or in buoyant, gull-like flight; often hovers, and when perched pumps tail up and down. Pale primary coverts on underwing separate from congeners. Juvenile browner, eye pale yellow not red. Races separated on size and intensity of plumage colour.

Habitat. Open savanna grasslands with scattered bushes and small trees; extends into arid steppe, desert or clearings in dense woodland, wherever prey is abundant. Outside breeding season, up to 500 birds may roost communally

in trees or reedbeds, spreading out by day to individual hunting territories.

Food and Feeding. Primarily rodents of 40-90 g; shrews, bats, small birds, reptiles and insects also predominate at times. Hunts from perch or hovers, usually making a slow descent in stages, with wings held in high dihedral above the back and feet extended below, and ending with a fast plunge into ground cover. Hovers in still or windy conditions. Often crepuscular in hunting.

Breeding. Peak laying at beginning or end of summer or wet season in sub-Saharan Africa and India, but recorded in all months in opportunistic reaction to rodent availability, especially that of larger species; more seasonal in N Africa and S Europe, Feb-Apr; Jan-Jun in Malaysia; Apr and Aug in Sumatra. Rapidly builds small platform of sticks and weeds, lined with grass, in fork of tree, bush or pylon, 2-20 m above ground. Usually 3-4 eggs (2-6); incubation 30-33 days; chicks have pale grey-brown down; fledging 30-35 days; may rear multiple broods in succession (e.g. 7 attempts in 19 months), with male taking over all feeding of fledglings, and female starting new clutch with a different mate.

Movements. Nomadic, ranging widely throughout its extensive range, in search of conditions supporting abundant prey; often travels long distances, and even crosses equator, e.g. from Transvaal (South Africa) to Uganda. Considerable monthly turnover, even in local populations which appear to be stable and sedentary, usually with males arriving first and remaining longest on territories, and females wandering about in search of mates and nesting opportunities.

Status and Conservation. Not globally threatened, CITES II. One of the commonest birds of prey throughout its wide range, e.g. estimated 44,000 pairs in Transvaal alone. In Borneo, rare in N, but widespread and locally common in Kalimantan; locally fairly common in Thailand and Sumatra; common in reserve of Nam Cat Tien (S Vietnam) in mid-1980's. Patchily distributed in some areas, notably India and Iberia; in mid-1980's, 150-200 pairs in Portugal, 100+ pairs in Spain. One of few species to prosper in areas of agriculture, bush clearing and heavy grazing, e.g. along R Nile; currently in expansion in several parts of range. Mobility and reproductive biology ensure optimum use of resources, repeated colonization of ephemeral or marginal habitats, high fecundity and maintenance of large megapopulations. Affected locally by rodenticides.

Bibliography. Ali & Ripley (1978), Allan (1983b), Barnard (1986), Beeher *et al.* (1986), Benson & Benson (1975), Bergier (1987), Brown *et al.* (1982), Clark & Banks (1992), Coates (1985), Collar (1978), Cramp & Simmons (1980), Etchécopar & Hue (1978), Ginn *et al.* (1989), Goodman *et al.* (1989), Grimes (1987), Lewis & Pomeroy (1989), Maclean (1993), Mackworth-Præd & Grant (1962), van Marle & Voous (1988), Medway & Wells (1976), Mees (1982), Meininger (1991), Mendelsohn (1982, 1983, 1984, 1988a, 1989), Mendelsohn & Jaksic (1989), Mian & Wajid (1990), Morel & Poulet (1976), Pakenham (1979), Paz (1987), Roberts (1991), Simeonov *et al.* (1990), Slotow *et al.* (1987), Slotow & Perrin (1992), Smythies (1986), van Someren (1956), Steyn (1971, 1982), Suetens & van Groenendael (1977), Tarboton (1977a, 1978a), Tarboton & Allan (1984), Thiollay (1978c).

20. Australian Black-shouldered Kite

Elanus axillaris

French: Élanion d'Australie

German: Australischer Gleitaar

Spanish: Elanio Australiano

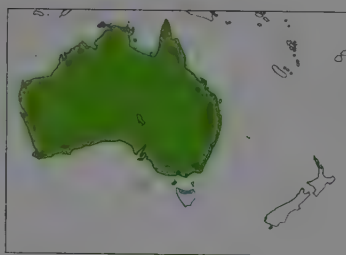
Taxonomy. *Falco axillaris* Latham, 1801, Sydney, New South Wales.

Sometimes regarded as race of *E. caeruleus*, with which it forms superspecies, along with *E. leucurus*; separated by plumage. Has been called *E. notatus* on the grounds that Latham's *axillaris* was supposedly unidentifiable and could have applied to *E. scriptus*, but the illustration examined by Latham clearly does not depict *scriptus*. Monotypic.

Distribution. Australia.

Descriptive notes. 33-37 cm; 181-365 g; wingspan 82-94 cm. Distinguished from sympatric *E. scriptus* by facial features, and by underwing: white inner half, black carpal spot, dark primaries. Differences from other congeners slight: size and body proportions, shade of upperparts, underwing carpal spot, and juvenile plumage. Female larger than male. Juvenile washed rusty on head and body, with feathers of back and upperwings tipped white.

Habitat. Grassland and other sparsely wooded habitats with ground cover, including savanna, farmland, heath, vacant urban grassy land. Nests in trees.



Food and Feeding. Mostly small rodents; occasionally small birds, lizards and insects. Diurnal, crepuscular and occasionally nocturnal, using moonlight. Forages by quartering and hovering, then dropping onto prey on ground.

Breeding. Season variable, throughout most of year with peaks in autumn and spring; continuous when food abundant, when pairs have 2 broods per year. Solitary, or in loose colonies when prey abundant. Platform of sticks 27-45 cm wide, 13-15 cm deep, lined with green leaves; placed 4-35 m above ground in canopy of live tree, rarely on artificial structure.

Usually 3-4 eggs (2-5); incubation 29-34 days; chicks have fawn first down, then pale grey second down; fledging 33-38 days; post-fledging dependence c. 1 month. Age at first breeding probably 1 year. Oldest ringed bird 3.5 years. Of all eggs laid 73% hatch, and 54% result in fledglings.

Movements. Resident populations in temperate coastal lowlands; others dispersive, partly migratory and irruptive in response to plagues of prey. Irregular in semi-arid zone; regular wintering on coast.

Status and Conservation. Not globally threatened, CITES II. Common and widespread; has increased in range and numbers in cleared and farmed areas of S Australia in response to creation of habitat and introduction of suitable prey.

Bibliography. Baker-Gabb (1984a), Condon (1937), Cupper & Cupper (1981), Hollands (1984), McLaughlin (1989), Marchant & Higgins (1993), Olsen & Marples (1993), Olsen & Olsen (1987a), Olsen, Crome & Olsen (1993), Pedler (1976), Ragless (1958), Schodde & Tidemann (1988).

21. White-tailed Kite

Elanus leucurus

French: Élanion à queue blanche

German: Weißschwanzaar

Spanish: Elanio Maromero

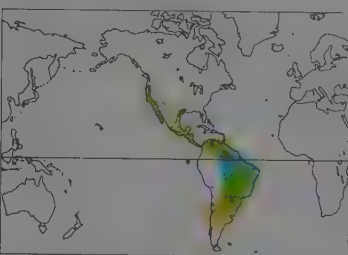
Taxonomy. *Milvus leucurus* Vieillot, 1818, Paraguay.

Forms superspecies with *E. caeruleus* and *E. axillaris*; these three sometimes considered a single species, but morphology and behavioural differences support specific status for *E. leucurus*. Two subspecies recognized.

Subspecies and Distribution.

E. l. majusculus Bangs & Penard, 1920 - W & S USA (from Oregon to C Florida, occasionally to South Carolina) and N Mexico; also most of Central America (race uncertain).

E. l. leucurus (Vieillot, 1818) - Panama, S through Amazonia to C Argentina (Mendoza and Buenos Aires) and C Chile (Valdivia).



Descriptive notes. 38-43 cm; c. 300 g; wingspan 100 cm. Above pale bluish grey with black shoulder, below white. Differs from *E. caeruleus* in underwing pattern; largest *Elanus*. Iris rufous orange, cere and legs yellow. Head grey, but for white forehead, supraorbital area and cheeks, and dark patch immediately above and in front of eye; white outer tail feathers contrast with grey central retrices. No sexual size dimorphism, but female somewhat darker grey above. Immature streaked brown and white on nape and back of crown, back brownish with white edging, throat and breast streaked cinnamon. Race *majusculus* larger.

Habitat. Open or cleared agricultural or range lands, lightly wooded savanna or marshes. Prospers in disturbed areas, e.g. farmland or dumps, and also in natural shrubland; both open and dense chaparral in Chile. In California (USA) always near riparian habitat. Usually below 1000 m in Colombia and Venezuela, but occurs up to 2600 m, and recorded at 4200 m in Peru.

Food and Feeding. Primarily mice and voles, but also other small mammals, occasionally birds, lizards and amphibians; 98% rodents, including large *Rattus norvegicus*, at one site in Chile. Often specializes on one prey species e.g. *Mus musculus* or *Mus californicus* in California, and *Akodon olivaceus* in Chile. Hunts by intermittent soaring, hovering and flapping flight, usually less than 30 m above the ground, rarely from a perch; most attempts to capture prey are initiated from hovering position. Males observed catching small birds in flight. May congregate to take advantage of locally abundant diurnal mammals, which tend to have pronounced, cyclical population fluctuations; up to 40 birds roost together at night in non-breeding season. Hunts all day, but peak of activity crepuscular in Chile; uses first 4 and last 4 hours of daylight in North America. Catches prey.

Breeding. Pairing starts in Jan. in California (USA); in Panama, eggs in Dec, fledged young in Jun; nesting Feb-May, in N South America; Sept-Nov in Chile and Argentina. In California, populations spread out and territories defended; elsewhere nests only c. 200 m apart. Stick nest lined with grass, high up in tall trees; sometimes uses old nests of other species, normally rebuilding. Normally 3-5 eggs, very rarely 6; incubation 30-32 days; second clutch possible in good years; chicks have greyish or buff first down, dark bluish grey second down; fledging c. 35-40 days. Both sexes build nest, but once copulation starts, male provides food until young near fledging.

Movements. Migratory or nomadic, when prey abundance declines; in California, one population stays in a reserve, despite sharp drop in prey (vole) abundance, even continuing to catch same proportion of voles, but presumably requiring more time per capture. Transition between migratory and resident populations unknown, especially in S South America: birds from extreme S of range (close N to C Chile in May-Jun, in Sumatra, most birds are austral migrants, although a few breed). Congregates in large flocks in winter. Often roosts in flocks, usually in trees; one flock of over 100 birds roosted overnight in tall sugarcane, after staging on ground in nearby ploughed field.

Status and Conservation. Not globally threatened, CITES II. Seems to be increasing over much of range, especially from S Mexico to Panama, with Nicaraguan birds apparently of Californian origin. Boom apparently due to intensified agriculture, especially year-round irrigation in California; also due to road building in Central America, which opened way for agriculture. Very rare E of Mississippi R, but appears to be spreading, with recent breeding records in S USA and sightings in much of USA; in mid-1970's, dramatic rise in winter in Oregon, where first nesting in late 1970's; nearly extirpated from California in early 20th century, but increased exponentially in period 1949-1978, although with strong fluctuations, population of Texas growing since 1968. In Costa Rica, numbers

up at any rate between late 1950's and 1960's. Increasing in Brazil and has recently spread into Bolivia from N Argentina, where is quite common.

Bibliography. Blake (1977), Bolander & Arnold (1965), Bond, J. (1964), Bond, R.M. (1940), Clark & Banks (1992), Clark & Wheeler (1989), Contreras *et al.* (1990), Cunningham (1955), Dixon *et al.* (1957), Eisenmann (1971), ffrinch (1985), Fjeldså & Krabbe (1990), Fraga (1984), Gallardo (1986), Greer & Bullock (1966), Haverschmidt (1959a, 1962, 1968), Hawbecker (1940, 1942), Henny & Anneer (1978), Hilty & Brown (1986), Housse (1935), Husain (1959), Jakšić & Delibes (1987), Jakšić & Jiménez (1986), Jakšić, Greene & Yáñez (1981), Jakšić, Rozzi *et al.* (1987), Johnson (1965), Koplin *et al.* (1980), Larson (1980), Mendelsohn & Jakšić (1989), Meserve (1977), Meyer de Schauensee & Phelps (1978), Miles (1964), Moore & Barr (1941), Morgan (1948), Orians & Paulson (1969), Palmer (1988), Parkes (1958), de la Peña (1992), Peyton (1915), Pickwell (1930, 1932), Pinto (1964), Pruett-Jones *et al.* (1980), Remsen & Ridgely (1980), Ridgely & Gwynne (1989), Russell (1964), Schlatter, Toro *et al.* (1980), Sick (1985a, 1993), Slud (1964), Stendell (1972), Stendell & Myers (1973), Stiles & Skutch (1989), Thiollay (1980b), Thurber & Serrana (1972), Voous (1969), Waian (1973), Waian & Stendall (1970), Warner & Rudd (1975), Watson (1940).

22. Letter-winged Kite

Elanus scriptus

French: Élanion lettré

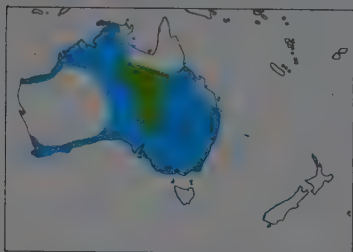
German: Schwarzschildläufer

Spanish: Elanio Escrito

Taxonomy. *Elanus scriptus* Gould, 1842, Cooper Creek, South Australia.

Monotypic.

Distribution. Australia, mainly in interior.



Descriptive notes. 34-37 cm; 160-427 g; wing-span 84-89 cm. Distinguished from sympatric *E. axillaris* and other congeners by black rings encircling eyes, enhancing more owl-like face; underwings with black line along inner half and pale primaries. Female larger than male. Juvenile washed rusty on head and body.

Habitat. Sparsely treed grasslands and plains of arid and semi-arid zones; occasionally irrupts to similarly open areas on coast. Nests in riparian woodland in arid zone.

Food and Feeding. Mostly rodents, especially *Rattus villosissimus*; occasionally other small mammals and insects. Normally nocturnal, like

major prey; this habit almost unique in family. Forages by quartering and hovering, dropping onto prey on ground.

Breeding. Season irregular; continuous (mostly autumn to spring) during times of abundant prey following rains, but little or no breeding in years between rat plagues. Loosely colonial; occasionally solitary. Platform of twigs and herbage 28-51 cm wide, 20-34 cm deep, lined with green leaves or cattle dung; placed 2-11 m above ground in canopy of live tree. Usually 4-5 eggs (3-6); incubation c. 36 days; chicks have cream first down, then fawn second down; fledging 30-35 days. Can breed within first year. Success varies according to rat abundance: 17 pairs laid 19 eggs and fledged 2 young in non-plague year; 9 nests produced 31 eggs and 19 fledglings during plague year.

Movements. Dispersive and irruptive. Breeding birds concentrate around rat plagues, slowly moving with advancing plague front. When plague collapses, many birds (mostly immatures) disperse randomly towards coast where they die of starvation. Subsequent repopulation of arid zone by nucleus of surviving adults that stay put.

Status and Conservation. Not globally threatened. CITES II. Conservation status is of some concern. Generally uncommon; core breeding range and population small and subject to habitat degradation by overgrazing, which exacerbates effects of regular droughts. Breeding colonies also threatened by increase of feral cats, which occupy nests and eat young. Irruptions give false impression of abundance; these birds are the doomed surplus.

Bibliography. Baker-Gabb & Pettigrew (1982), Cameron (1974), Cupper & Cupper (1981), Ey (1984), Garnett (1992), Hollands (1977, 1979, 1984), Marchant & Higgins (1993), Olsen & Marples (1993), Olsen, Crome & Olsen (1993), Pettigrew (1982), Schodde & Mason (1980), Schodde & Tidemann (1988).

Genus CHELICTINIA Lesson, 1843

23. African Swallow-tailed Kite

Chelictinia riocourii

French: Élanion nacler

German: Schwalbenschwanzar

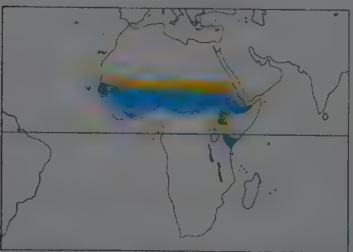
Spanish: Elanio Golondrina

Other common names: Swallow-tailed/Scissor-tailed/Fork-tailed Kite

Taxonomy. *Elanoides riocourii* Vieillot, 1822, Senegal.

Sometimes included within genus *Elanus*, to which closely related, but usually awarded monotypic genus on grounds of morphology, insect food and gregarious habits. Monotypic.

Distribution. Senegambia E to Ethiopia and Somalia, and S to NE Uganda and NE Kenya, in Kedong Valley.



Descriptive notes. 35 cm; one fat individual 110 g. Tern-like in flight, and in coloration and elongate outer tail feathers, with black bar across underwing-coverts. Pumps tail up and down when agitated like *Elanus caeruleus*. Juvenile has rufous edges to dorsal feathers and less forked tail.

Habitat. Arid sub-Saharan steppe and scrub savanna. Roosts colonially at night.

Food and Feeding. Mainly insects and arachnids; takes more lizards and rodents when it is breeding. Hunts mainly on the wing, soaring and hovering buoyantly, before descending to hawk prey or pick it up from ground; some-

times quarters low over ground. Often eats on the wing. Usually gregarious, hunting in loose flocks, sometimes over cattle. Attracted to grass fires to catch fleeing insects, and hundreds may gather at grasshopper emergences.

Breeding. Laying May-Jun in W Africa; Mar-Jun, Aug in N Kenya. Builds small stick nest in dense thorny bush, often in association with other nesting raptor species; once just below active nest of Secretarybird (*Secretarius secretarius*). Nests become coated in white droppings and conspicuous. Usually 4 eggs; incubation and fledging periods unrecorded. Often nests in loose colonies.

Movements. Performs regular movements, but extent varies annually. In W Africa, moves S in Nov at start of dry season, and N to breed in Sahel zone when rains start in Feb. In E Africa moves S in Mar to breed, also during rainy season; small population resident in some areas of N Kenya, e.g. Kedong Valley; other birds may occur further S, but generally only as irregular non-breeding vagrants.

Status and Conservation. Not globally threatened. CITES II. Little studied; status difficult to assess due to nomadic habits. May be locally common at times, but vulnerable to degradation of Sahel zone. Appears to have declined over much of W Africa since 1970, especially during locust control operations of 1986-1989, despite its potential as an important locust predator. Vulnerable to pesticides.

Bibliography. Ash & Miskell (1983), Blankenship *et al.* (1971), Brown *et al.* (1982), Davey & Davey (1980), Dewhurst & Fishpool (1984), Gatter (1988), Gore (1990), Grimes (1987), Hollom *et al.* (1988), Jensen & Kirkeby (1980), Lewis & Pomeroy (1989), Mackworth-Præd & Grant (1957-1973), Morel & Morel (1990), Mullie *et al.* (1992), Nikolaus (1987), Serle *et al.* (1977), Short *et al.* (1990), Snow (1978), Sutton *et al.* (1984), Thiollay (1978c).

Genus ROSTRHAMUS Lesson, 1830

24. Snail Kite

Rostrhamus sociabilis

French: Milan des marais

German: Schneckenweih

Spanish: Caracolero Común

Other common names: Everglade Kite (*plumbeus*)

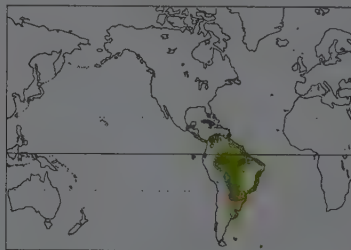
Taxonomy. *Herpetotheres sociabilis* Vieillot, 1817, Corrientes, near Río de la Plata, Argentina. Highly specialized genus, with no clear taxonomic affinities to other genera. Cuban population sometimes awarded separate race, *levis*. Three subspecies currently recognized.

Subspecies and Distribution.

R. s. plumbeus Ridgway, 1874 - Florida Everglades (SE USA), Cuba and I of Pines.

R. s. major Nelson & Goldman 1933 - E Mexico and Petén (Guatemala).

R. s. sociabilis (Vieillot, 1817) - Honduras and Nicaragua through Panama to South America, occurring W of Andes in Colombia and Ecuador, and E of Andes throughout to NE Argentina, except Guyana Massif and Brazilian Plateau.



Descriptive notes. 40-45 cm; 360-393 g; wing-span 115 cm. Very slender, strongly curved bill; both sexes differ from *R. hamatus* in red iris. Adult male slate grey, with black wing tips; black tail with large white patch at base and narrow white terminal band; bare parts orange-red, duller outside breeding season. Female buffy brown above, white to buffy with heavy brown streaking below; bare parts yellow to orange; slightly larger than male. Immature similar to female, but iris brown; takes 4 years to attain full adult plumage. Races distinguished by size.

Habitat. Lowlands of subtropics to tropics; needs marshes continuously flooded for at least

2 years to accumulate sufficient prey (snails). In Surinam, large flocks, mostly of immatures, congregate throughout year around rice plantations. In Florida (USA), 97% of foraging over sparsely vegetated marshes, as can not feed where dense, sometimes exotic (e.g. water hyacinth), vegetation hides prey. Congregates at end of day in large communal roosts, of over 1000 birds, often associated with herons, in marshes; same sites can be nesting colonies. Most roosts not used for more than 3 years, reflecting changing conditions of marshes, and nomadic habits of birds, which must keep near prime snail areas.

Food and Feeding. Highly specialized morphologically to feed on apple snails (*Pomacea*), but will take other snails and very different prey during droughts, including turtles, crabs, rodents. In Venezuela, diet shifts to 10% freshwater crabs, as snail availability decreases. Takes medium-sized snails disproportionately; adults take larger prey than juveniles, although largest items usually taken to nest. Modified bill used to sever snail's columellar muscle, freeing it quickly and easily from shell. Snatches snails from shallow water (down to 16 cm deep) with feet, then perches to extract snail from shell. Hunting occurs from perch, with bird sallying short distances to a snail seen from perch; also from coursing flight (less than 10 m up) over appropriate habitat; females more successful at coursing hunting than males. Occasionally steals snails from foraging Limpkins (*Aramus guarauna*), approaching and striking from behind. Forages throughout most of day. In Florida, birds seen defending feeding territories where snails superabundant in 30 m x 75 m stretch of canal. Up to 26% of birds arriving at roost carry snails in bill.

Breeding. Duration variable, 5-10 months. Nests Feb-Jul in USA; rainy season in tropics, e.g. Jan-Jul in Surinam; Oct-Feb in Argentina. Nests in loose colonies, nests sometimes only a few metres apart; 90 nests in one colony in Surinam. Stick nests often on small branches of live or dead trees. Both sexes take part in all stages of nesting. Usually 2-3 eggs; second and third clutches possible; incubation 26-28 days; chicks have buff first down, dark greyish brown second down; fledging c. 40-49 days, although birds can leave nest considerably earlier. First breeding at only 10 months old. Practises both serial polygyny and polyandry in Florida and N South America; when food abundant, either member of pair may desert to renege with different mate (see page 75). Nests with smaller clutches and those near good food supplies have higher chance of desertion. Very low mortality of single-parent chicks, e.g. only 1 from 28 nests. Very high overall failure rate, e.g. 86-64% of nests in a study in Florida; mostly due to nest predation and unstable nest structures; nonetheless, this population has increased in years of prey abundance, because of renegeing, long breeding season and high survivorship of fledged young. Species seems to have low fecundity, moderate first year survival rate and very high adult survival rate.

Movements. Southernmost populations migratory, although transition between migratory and resident populations not documented; otherwise nomadic in response to droughts or drainage of feeding areas. Leaves S Brazil in Apr, returning in Sept, some birds moving to Pantanal, where groups of up to 600 congregate in feeding areas; most common along R Paraguay in Oct, when large numbers move S in loose flocks. Occasionally wanders to lower temperate zone in Andes. Will commute over large distances between feeding and nesting areas.

Status and Conservation. Not globally threatened. CITES II. Often abundant in suitable habitat throughout most of range. "Boom or bust" cycles closely tied to droughts in Florida, where population c. 500 individuals, surveyed annually. Rare through much of Central America; on increase in Cuba, where now widespread. Locally fairly common in Colombia; large numbers congregate in Chaco-Pantanal zone outside breeding season. Nomadic habits make it difficult to protect species with "key" areas, as flocks will move off when droughts hit. Florida population was down perhaps to under 50 individuals in mid-1960's, but now seems to have recovered significantly with eightfold increase from lowest levels by 1980, when most of population confined to areas around three freshwater containment areas; breeding success entirely dependent upon water levels in swamps, now largely controlled by man; during drought periods, some areas can be maintained flooded to support the population. In Brazil, adversely affected by introduced *Tilapia* fish, which remove vegetation on which snails live. Also affected in many areas by drainage or deterioration of wetlands. Pesticides

may be major threat, and very high concentrations have been found in nestlings and eggs in Florida; in Surinam, 50 birds found dead after spraying of rice fields.

Bibliography. Albuquerque *et al.* (1986), Amadon (1983), Beissinger (1983, 1984, 1986, 1987a, 1987b, 1990a, 1990b), Beissinger & Snyder (1987), Beissinger & Takekawa (1983), Beissinger, Sprunt & Chandler (1983), Beissinger, Thomas & Strahl (1988), Blake (1977), Bourne (1985a, 1985b), Carey (1985), Chandler & Anderson (1974), Cintra & Yamashita (1990), Contreras *et al.* (1990), Fjeldså & Krabbe (1990), Garrido (1985), Haverschmidt (1954, 1959b, 1962, 1970), Hayes (1991), Hilty & Brown (1986), Kushlan & Bass (1983b), Mader (1981), Meyer de Schauensee & Phelps (1978), Miller & Tilton (1985), Murphy (1955), Nichols *et al.* (1980), Nicholson (1926), Palmer (1988), de la Peña (1992), Pinto (1964), Ridgely & Gwynne (1989), Rodgers *et al.* (1988), Sick (1985a, 1993), Slud (1964), Snyder & Kale (1983), Snyder & Snyder (1969, 1970), Snyder *et al.* (1989), Sprunt (1945), Stieglitz & Thompson (1967), Stiles & Skutch (1989), Sykes (1979, 1983a, 1983b, 1984, 1985a, 1985b, 1987), Sykes & Kale (1974), Takekawa & Beissinger (1983, 1989), Vermeer *et al.* (1974), Voous (1969), Voous & Van Dijk (1973), Wetmore (1965), Wiley (1985, 1986), Wotzkow (1985).

25. Slender-billed Kite

Rostrhamus hamatus

French: Milan à long bec

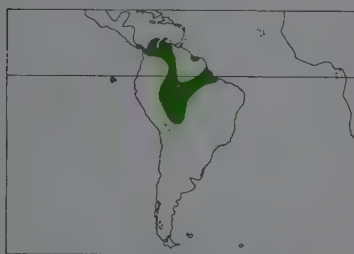
German: HakenweiB

Spanish: Caracolero Plomizo

Taxonomy. *Falco hamatus* Temminck, 1821, Brazil.

Traditionally, and perhaps more appropriately placed in its own genus, *Helicolestes*, due to marked differences with *R. sociabilis* in proportions and shape (especially in flight), style of flight, calls, display and habitat. Monotypic.

Distribution. E Panama, through N & E Colombia, to W, N & SE Venezuela and Surinam; also S through Amazonian Brazil to E Peru and N Bolivia (Beni); limits of range poorly documented, in part due to confusion with *R. sociabilis*.



Descriptive notes. 37-41 cm; male 377-448 g, female 367-485 g. Slate grey, primaries and tail black; iris to yellow white, legs, cere and facial skin orange-red. Separated from male *R. sociabilis* by eye colour, dark rump, broader wings and much shorter tail. Sexes alike. Immature similar, but tail has 2-3 white bars and white tip; buff or white edging to wing-coverts, secondaries and rump.

Habitat. Flooded forest margins. Rain forest, edges of swampy forest, especially *várzea*; also stagnant lagoons, and wooded plantations, up to 700 m. Regularly soars in groups, although not very high up.

Food and Feeding. Specializes on snails of genus *Pomacea*. Extracts snail from shell by piercing and severing its columellar muscle at point of attachment to shell. Usually hunts from a low perch. In one study, 8% of diet was freshwater crabs (*Dilocarcinus dentatus*).

Breeding. Poorly known. In Venezuela and the Guianas, nests Jul-Oct, during wet season. Nests about 1 km apart. Flimsy stick nest, on average 14 m high on slanting limbs or in crotch of tree, in flooded gallery forest; trimmed with fresh boughs by both adults. 2 eggs (possibly more); incubation c. 30 days; chicks have brown down with some whitish markings; fledging 35 days, with birds flying at 40 days. Both sexes incubate, brood and feed young. No evidence of sequential polyandry or polygyny, as in *R. sociabilis*.

Movements. No movements reported.

Status and Conservation. Not globally threatened. CITES II. Poorly known, and requires further study. Restriction to gallery forest and flooded forest may make species very susceptible to effects of deforestation; highly specialized diet.

Bibliography. Amadon (1964), Beissinger *et al.* (1988), Blake (1977), Cabot & Serrano (1986), Haverschmidt (1959b), Hilty & Brown (1986), Mader (1981), Meyer de Schauensee & Phelps (1978), Pearson (1975), Pinto (1964), Ridgely & Gwynne (1989), Sick (1985a, 1993), Thiollay (1989b), Voous (1969), Voous & Van Dijk (1973), Wetmore (1965).

Genus HARPAGUS Vigors, 1824

26. Double-toothed Kite

Harpagus bidentatus

French: Milan bidenté

German: DoppelzahnweiB

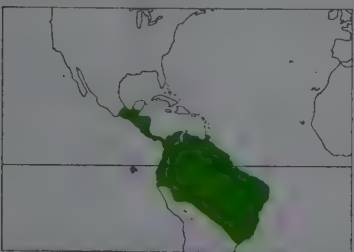
Spanish: Milano Bidentado

Taxonomy. *Falco bidentatus* Latham, 1790, Cayenne.

Genus distinctive, with no very close allies, but belongs in same subgroup as *Elanus*; relationship with *Accipiter* claimed, due to similarity in plumage, but now discredited; some similarities with *Aviceda*. Two subspecies recognized.

Subspecies and Distribution.

H. b. fasciatus Lawrence, 1869 - E Mexico (Oaxaca and Veracruz) to W Colombia and W Ecuador.
H. b. bidentatus (Latham, 1790) - E Colombia and E Ecuador through Amazonia to E Bolivia (Beni) and SE Brazil; Trinidad.



Descriptive notes. 33-38 cm; 168-229 g. Double "tooth" in upper mandible. More similar to an *Accipiter* than to other kites; prominent white undertail-coverts. Head dark grey, throat white with dark central stripe; dorsally paler grey, blackish tail tipped grey with three greyish bands; breast and belly predominantly rufous, with grey and whitish barring on belly, and sometimes on lower breast. Eyes red, cere greenish yellow, legs and feet yellow. Female slightly larger with browner wings and rump, barred breast and much more rufous ventrally. Immature deep brown above; ventrally whitish to buff with vertical brown streaking. Race *fasciatus* more heavily barred on breast and upper belly; somewhat less rufous below.

Habitat. Tropical and occasionally subtropical zones, to c. 1200 m in Colombia, 2100 m in Ecuador; rain forest, forest edge, clearings, second growth and disturbed forest. One nest in highlands of Costa Rica, at 1233 m. Soars over the forest, but hunts under the canopy.

Food and Feeding. Mostly arthropods and small vertebrates, especially lizards and sometimes frogs. Prey usually taken in upper storeys of forest. Regularly follows primates quite closely, catching

lizards, cicadas, other arthropods and tent-making bats (once) flushed by the monkeys. Sometimes two adults follow, occasionally with juvenile, perching from 30 m away to within periphery of foraging troop. Reported following: tamarins *Saguinus mystax*, *S. fuscicollis* and *S. bicolor* in Brazil; often squirrel monkey *Saimiri oerstedii*, and sometimes capuchin *Cebus capucinus* in Costa Rica and Panama; also tamarin *Saguinus geoffroyi*, and less frequently red howler (*Alouatta*) and spider monkeys (*Ateles*) in Panama. 19% of *Harpagus* observations had kites in association. In some areas, spends twice as much time with monkeys in rainy season as in dry season; elsewhere, no significant diurnal or seasonal variation in attendance of monkey troops. Will hover over resting tamarin, touching it with talons, perhaps to get it moving. Capuchins (*Cebus*) sometimes try to catch perching kites; *Saguinus mystax* and *S. fuscicollis* will try to drive away perched kites, and give alarm calls when kites are flying. Relationship seems to be parasitic rather than commensal, with no apparent protection through similarity to more aggressive hawks.

Breeding. Nest building in early Apr in Mexico; incubation in early Jul in Panama. Nest is shallow saucer of twigs in small limbed fork of tree; placed 7-33 m off ground, often at forest edge; in Panama, nest in thick foliage of spiny cedar (*Bombacopsis fendleri*). Courtship feeding recorded. One nest in Costa Rica had 2 nestlings. After fledging 1 parent roosts on nest while young still in vicinity. One nest in Panama unsuccessful due to predation by toucan.

Movements. No movements known.

Status and Conservation. Not globally threatened. CITES II. No immediate cause for concern, but species will not persist in areas of extensive deforestation. Relatively common in appropriate habitat. Estimated average density of at least 15 individuals/10,000 ha at one forest site in French Guiana.

Bibliography. Amadon (1961b, 1964), Blake (1977), Boinski & Scott (1988), Boinski & Timm (1985), Cabot & Serrano (1986), Egler (1991), French (1992), Fontaine (1980), Greenlaw (1967), Heymann (1992), Hilty & Brown (1986), Laughlin (1952), Meyer de Schauensee & Phelps (1978), Monroe (1968), Olson (1987), Pinto (1964), Ridgely & Gwynne (1989), Schubart *et al.* (1965), Sick (1985a, 1993), Skutch (1965), Slud (1964), Stiles & Skutch (1989), Terborgh (1983), Thiollay (1985b, 1989b, 1991a), Voous (1969), Wetmore (1965).

27. Rufous-thighed Kite

Harpagus diodon

French: Milan diodon

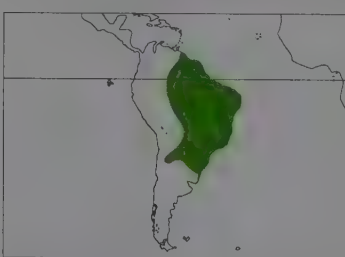
German: BraunschenkelweiB

Spanish: Milano Muslirrufo

Taxonomy. *Falco diodon* Temminck, 1823, Villa Viçosa, Rio Peruípe, Bahia, Brazil.

Plumage shows very close resemblance to *Accipiter bicolor*, perhaps suggesting protective mimicry. Monotypic.

Distribution. Locally in the Guianas, through E Brazil (Amazonia W to R Branco and R Purús) S to E Bolivia (Santa Cruz), Paraguay and N Argentina (Misiones, Jujuy and Salta).



Descriptive notes. 30-35 cm. As in *H. bidentatus*, upper mandible has two notches, resembling teeth. Both adult and immature plumages strikingly similar to corresponding plumages of *Accipiter bicolor*. Above slate grey, tail feathers with three pale bars and white tips; throat whitish with dark central streak; below grey fading to white undertail-coverts, with chestnut thighs. Eye red or orange, cere lemon yellow, legs yellow to orange. Female similar, but slightly larger. Immature dark brown above; side of head streaked; below whitish with fuscous streaking on breast and belly, barring on flanks; chestnut thighs.

Habitat. Primary lowland rain forest. Reported by some authors to be present in dense forest, but by others to be found in more open forests than *H. bidentatus*; in French Guiana, found only in primary forest, while *H. bidentatus* is more tolerant of disturbed forest and second growth. Regularly soars over the forest, but hunts in middle to lower strata. More mesic and open forests in E Brazil, but dense forest in Argentina.

Food and Feeding. Very few data available; insects, including cicadas; presumably also lizards. Close similarity to bird-eating *Accipiter bicolor* may frighten small birds, which might otherwise mob present species and diminish its foraging success on lizards and large insects. Sometimes follows *Eciton* army ant swarms, feeding on flushed insects.

Breeding. Very little known. One nest in Minas Gerais, Brazil, built of twigs, lined with leaves in a small tree; contained 2 eggs on 21 Oct (austral spring).

Movements. No information available; presumably sedentary.

Status and Conservation. Not globally threatened. CITES II. Status very poorly known; generally rare, but perhaps overlooked. Estimated average density of at least 4 individuals/10,000 ha at one site in French Guiana.

Bibliography. Amadon (1961b), Belton (1984), Blake (1977), Navas & Bó (1991), Olrog (1985), de la Peña (1992), Pinto (1964), Remsen & T aylor (1989), Ruschi (1979), Sick (1985a, 1993), Snyder (1966), Thiollay (1985b, 1989a, 1989b), Willis (1976).

Genus ICTINIA Vieillot, 1816

28. Mississippi Kite

Ictinia mississippiensis

French: Milan du Mississippi

German: MississippweiB

Spanish: Elanio del Mississippi

Taxonomy. *Falco mississippiensis* [sic] Wilson, 1811, below Natchez, Mississippi.

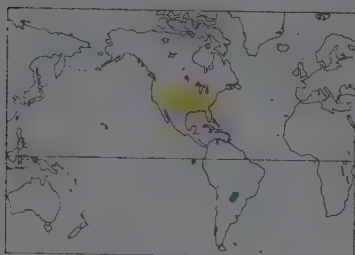
No clear affinities to other genera. Forms superspecies with *I. plumbea*. Monotypic.

Distribution. Southern tier of USA, from Arizona to Florida. Winters in South America, S to N Argentina and Paraguay.

Descriptive notes. 35-38 cm; 220-390 g, female slightly larger; wingspan 96 cm. More like falcon than hawk; adult solid medium grey body with blackish wings and tail. Paler than *I. plumbea*, with orangish to blackish legs; lacks rufous in wing and whitish bars on undertail. Juvenile brown with streaked underparts, and conspicuous pale bars on tail.

Habitat. Woodlands, shelterbelts (windbreaks), and clumps of trees (farm lots) for nesting; woodland edge, grassland and savanna preferred for feeding. Common in man-altered habitats, e.g. agricultural land and some towns. Riparian habitats with trees. In Neotropical non-breeding grounds also occupies open and edge habitats, and savanna; forages over woodland.

Food and Feeding. Insects constitute c. 90% of food, e.g. cicadas, katydids, grasshoppers, dragonflies and beetles. Vertebrates taken are mainly amphibians, reptiles, small rodents or bats. Feeds mainly



on the wing in apparently effortless manner; feeds on insects flushed by herding ungulates or by fires.

Breeding. May-Jul. Nests in loose semi-colonial aggregations; as little as 0.3 ha per territory, or nests 125 m apart, in linear, riparian habitat. Nest built 2-45 m above ground, in trees of many species, but conifers little used; stick nest frequently appears flimsy, and usually placed in branch crotches with 3-4 supporting limbs; shallow nest bowl lined with mat of green leaves, and greenery added frequently. Usually 2 eggs; incubation 29-31 days; chicks have white down, with greyish black eye-rings

and lores; fledging c. 34 days, but chicks may climb from nest by day 25. Found paired as yearlings, but yearlings are also helpers at nests with adult pairs. May live to 8-9 years, but high 2nd year mortality of 50-60%. Nest success c. 55% of attempts; c. 0.6 young fledged per attempt.

Movements. Long distance Neotropical migrant; pre-migratory flocks by early Aug. Loose aggregations of 200-300 birds moving S by early Sept. Birds move S as far as N Argentina and Paraguay, but extent of Neotropical range poorly known. May remain on austral grounds into Mar. In late Apr, as many as 2300 birds per day moving N through coastal Mexico.

Status and Conservation. Not globally threatened. CITES II. Declined early in century but currently (1993) on increase, perhaps because of habitat modifications involving tree planting in steppe regions and opening of forests elsewhere. Range expanding; has recently colonized towns in plains and moved into riparian regions in SW. Total population may be a minimum of 274,000 individuals (migration count). Not threatened by pesticides. Lack of reforesting, after clutch loss, and small clutch sizes reduces reproductive potential, which might be a threat if mortality increased.

Bibliography. Blake (1977), Bolen & Flores (1993), Boteho *et al.* (1993), Contreras *et al.* (1990), Davis (1989), Eisenmann (1963), Evans (1981), Fitch (1963), Friedmann (1950), Gennaro (1988), Glinski & Gennaro (1988), Glinski & Ohmart (1983), Hilty & Brown (1986), Johnsgard (1990), Kalla & Alsop (1983), Love *et al.* (1985), Meyer (1990), Monroe (1968), Palmer (1988), Parker (1974, 1976, 1977), Parker & Ogden (1979), Parker & Ports (1982), de la Peña (1992), Ridgely & Gwynne (1989), Shaw (1985), Shaw & Maxwell (1988), Sick (1985a, 1993), Slud (1964), Smith, J.W. (1986), Smith, N.G. (1985), Snyder & Snyder (1991), Snyder & Wiley (1976), Sweet (1986, 1991), Thiollay (1977d, 1980a).

29. Plumbeous Kite

Ictinia plumbea

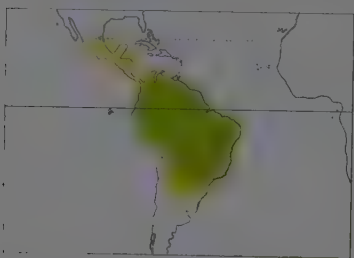
French: Milan bleuâtre

German: Schwebeweih

Spanish: Elanio Plomizo

Taxonomy. *Falco plumbeus* Gmelin, 1788, Cayenne.

Sometimes treated as conspecific with *I. mississippiensis*, with which forms superspecies. Monotypic. **Distribution.** NE Mexico (Tamaulipas) S through Central America to South America, W of Andes S to W Ecuador, E of Andes S to Paraguay and N Argentina.



Descriptive notes. 34-37.5 cm; male 190-267 g, female 232-280 g. Inner webs of primaries chestnut rufous, very conspicuous in flight; wings longer in relation to tail than in paler *I. mississippiensis*, extending beyond tail when bird perched. Above blackish slate grey; below and on head pale grey; tail black with 2-3 pale bars on undersurface. Legs yellow to orange red, iris red (yellow in Ecuador). Female slightly larger. Immature heavily streaked dusky on head, neck and underside; back blackish, with contour feathers tipped white; tail with three distinct bars below; rufous wing patch of adult also present.

Habitat. Lowlands of tropical and subtropical zones, along forest edge and gallery forest; also over primary forest, often near rivers. Recorded at 2300 m and 2600 m in Colombia.

Food and Feeding. Insects are primary prey, representing over 95% of recorded prey items; a few snakes and snails also reported. Hunts from perch or on the wing, often in flocks; most prey captured in flight, but some snatched off canopy foliage. Seasonally feeds in association with marmosets in Minas Gerais, SE Brazil; follows singly or in pairs for 2-6 hours per day, in morning, catching fleeing cicadas in the air after short flights.

Breeding. Mar in Central America; Mar-May in Colombia; Aug near Puyo, EC Ecuador; starts in Sept in Argentina, while migrating flocks still arriving, with chicks in Dec and Feb. Stick nests shallow but bulky, placed high in trees on thick branches, sometimes over water in mangrove swamps. 1-2 eggs; incubation 32-33 days; chicks have white down; fledging c. 1 month. Both adults feed young in nest. Nesting pairs very aggressive to any passing bird near the nest; one adult will remain perched over nest for hours on end.

Movements. Migratory in N and S of range in respective autumns; N birds move S through Panama in Aug and Sept, returning to breed in Mar; Central American population certainly migratory, while even those in N Venezuela and Colombia may migrate S during dry season, when insects less abundant. Limits of permanently resident populations not known. Flocks appear sporadically over C Amazon; may be nomadic migrants.

Status and Conservation. Not globally threatened. CITES II. Relatively common, e.g. in parts of Brazil and Colombia. Estimated average density of at least c. 9 individuals/10,000 ha at one forest site in French Guiana.

Bibliography. Belton (1984), Blake (1977), Davis (1989), Contreras *et al.* (1990), Eisenmann (1963), Ferrari (1990), Fjeldså & Krabbe (1990), Haverschmidt (1962), Hilty & Brown (1986), Marroquín *et al.* (1992), Meyer de Schauensee & Phelps (1978), Monroe (1968), de la Peña (1992), Pinto (1964), Ridgely & Gwynne (1989), Ruschi (1979), Russell (1964), Sick (1985a, 1993), Skutch (1947a), Slud (1964), Süles & Skutch (1989), Terborgh & Weske (1975), Thiollay (1989a), Voous (1969), Wetmore (1965).

Genus MILVUS Lacépède, 1799

30. Red Kite

Milvus milvus

French: Milan royal

German: Rotmilan

Spanish: Milano Real

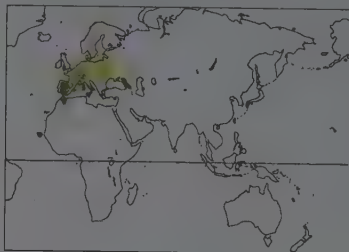
Taxonomy. *Falco Milvus* Linnaeus, 1758, Sweden.

Race *fasciicauda* may be distinct species; hybridizes with *M. migrans*. Two subspecies recognized.

Subspecies and Distribution.

M. m. milvus (Linnaeus, 1758) - S Sweden E to Ukraine and S through C Europe to W & C Mediterranean Basin; Wales; Caucasus; formerly Canary Is.

M. m. fasciicauda Hartert, 1914 - Cape Verde Is.



Descriptive notes. 61-66 cm; 757-1221 g; wingspan 175-195 cm. Larger than *M. migrans* and redder brown; tail more clearly forked and reddish on top; head whiter; underwing shows larger, whiter patches on primaries. Juvenile has paler body, darker head and less rusty coloured tail. Race *fasciicauda* smaller and darker. **Habitat.** Open wooded land; varied country, including forests or woods mixed with farmland, pasture or heathland. Normally at low or medium altitudes, but occurs in woods up to 2500 m in Morocco. In winter, tends to occupy more open areas, e.g. farmland without trees, wasteland, scrub and wetlands; also in winter.

roosts in groups of up to 100+ in clumps of trees, which may be traditional sites, although sedentary adults seem to continue roosting on or near their nests. Historically occurred in cities, e.g. urban scavenger in London in 16th century; still quite closely associated with man, visiting rich feeding areas on edges of towns, e.g. rubbish dumps.

Food and Feeding. Wide range of food types, but essentially carrion and small or medium-sized mammals and birds; diet varies according to local availability, with proportionally more prey captured during breeding. Carrion includes sheep and other livestock, dogs, cats, chickens and their eggs, and all sorts of small animals, including animals knocked down on roads and those wounded by hunters. In Doñana (S Spain), Greylag Goose (*Anser anser*) and other Anatidae are important source of carrion, due to their abundance in winter. Mammals hunted include rodents (voles, rats, mice, hamsters, muskrats), insectivores (moles, shrews), lagomorphs (rabbits, hares); birds, especially juveniles, include Corvidae (magpies, jackdaws, crows), Black-headed Gulls (*Larus ridibundus*) in Wales, and thrushes, larks and starlings. Reptiles, amphibians and fish generally much less important, as (at least in terms of weight) are invertebrates, e.g. beetles, grasshoppers and earthworms, all taken on ground, and alate ants, taken on wing. Forages mainly in open areas, with low flapping or gliding flight, or by diving onto terrestrial prey from higher, soaring flight. Often visits rubbish dumps in search of offal and waste from abattoirs; from nest will travel up to 8 km to hunt, and from roost moves much further afield.

Breeding. Laying Mar-May. Nests in trees, coniferous or broad-leaved, in forests, woods or clumps of trees. Each pair normally has several nests, using same one each year or alternating. Nest built in fork of tree or on wide side branch; platform of sticks which often includes rags or plastic, and normally lined with wool. Normally 2 eggs, sometimes 3 (1-4), laid at interval of 3 days; replacement laying occurs; incubation 31-32 days per egg, essentially by female, starting with first egg; female also broods and feeds chicks, though male brings most food; chicks have buff-coloured first down, second down tinged reddish; fledging 50-60 days; chicks fed by adults for at least 2-3 weeks more. 1 or 2 chicks fledge, very occasionally 3. First breeding sometimes at 2 years, but normally later, up to 7 years. Adult survival rate possibly 95% in Wales. Can live to 26 years old (38 in captivity). **Movements.** Mainly migratory in N and C Europe, although increasing tendency to winter in these areas, including S Sweden. Populations in S of range and Wales sedentary, with varying degree of dispersal of juveniles. The vast majority of migrants winter in S France and especially Iberian Peninsula, passing over W Pyrenees, where 10,300 birds recorded on autumn migration in 1989. Some migration to N Africa, mainly via Gibraltar; recorded S even to S Africa.

Status and Conservation. INSUFFICIENTLY KNOWN. CITES II. Historical decline from 19th century or earlier, leading to current disjunct distribution; basic causes direct persecution and use of poisoned baits. Following protection measures, notable recovery in C and N Europe. World population estimated in early 1990's at 11,000-12,000 pairs, subject to considerable variation with new data about certain populations. Highest estimates are for France with c. 2300-2900 pairs. Germany c. 4000-4500 pairs, Spain perhaps 3000 pairs, Switzerland c. 230-300 pairs, Italy 180-230 pairs (in decline), Poland c. 300-500 pairs, and Sweden c. 200 pairs. Almost wiped out of SE Europe; very rare in former USSR; formerly common, though not numerous in W & C Ukraine, but, due to deforestation and direct persecution, has declined steeply, and now very rare; possibly extinct in Turkey. Only a few dozen pairs in Morocco; extinct as breeder in Canary Is at end of 1960's, probably due to massive use of insecticides against locusts; in Cape Verde Is (race *fasciicauda*) has hybridized with invading *M. migrans*; by late 1980's, possibly only 50-100 birds remained, and these hybridized to greater or lesser degrees. Status in Mediterranean islands of some concern, although population seems stable in Corsica, with 100-180 pairs in early 1990's. Almost extinct in Britain by end of 19th century; residual Welsh population has gradually grown, reaching 79 breeding pairs in 1992; reintroduced to Scotland and England in 1989, breeding successfully for first time in 1992. Main threats still include hunting, as species conspicuous with slow flight, making it an easy target for shooters; poisoning too continues; may also be greatly affected by decline in extensive livestock farming, and elimination of small rural rubbish dumps.

Bibliography. Ali & Ripley (1978), Bergier (1987), Blanco, González & Hiraldo (1990), Blanco, Hiraldo & Heredia (1990), Blanco, Hiraldo *et al.* (1987), Borodin (1984), Brown *et al.* (1982), Bustamante (1993), Bustamante & Hiraldo (1993), Collar & Andrew (1988), Cortone *et al.* (1994), Cramp & Simmons (1980), Davies & Davis, P.E. (1973), Davis, P.E. & Davis, J.E. (1981), Davis, P.E. & Newton (1981), Dementiev & Gladkov (1951), Dobler (1991), Evans & Pienkowski (1991), Fily & Perennou (1990), Fluczynski (1981), Flint *et al.* (1984), Gónsbol (1986), Handrinos & Demetropoulos (1983), Heredia (1990), Heredia *et al.* (1991), Hiraldo *et al.* (1993), Kjellen (1992), Korpimäki (1985), McGrady *et al.* (1994), Newton, Davis, P.E. & Moss (1981), Par (1987), Simeonov *et al.* (1990), Sylven (1977a, 1977b), Veiga & Hiraldo (1990).

31. Black Kite

Milvus migrans

French: Milan noir

German: Schwarzmilan

Spanish: Milano Negro

Other common names: Black-eared/Eared/Large Indian Kite (*lineatus*); Pauran/Indian Kite (*goyindai*); Yellow-billed Kite (*aegyptius*, *parasitus*); Fork-tailed Kite (*affinis*)

Taxonomy. *Falco migrans* Boddaert, 1783, France.

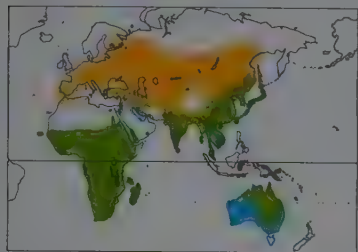
Hybridizes with *M. milvus* on Cape Verde Is. Several of races frequently awarded separate species status, most notably *lineatus* and *aegyptius* (incorporating *parasitus*); intergradation indicates probably best regarded as single species, with several well marked races. Seven subspecies normally recognized.

Subspecies and Distribution.

M. m. migrans (Boddaert, 1783) - NW Africa and Europe E to C Asia (Tien Shan) and S to Pakistan; winters S to Africa S of Sahara.

M. m. lineatus (J. E. Gray, 1831) - Siberia E to Amurland and Japan S to N India, N Burma and N China and Ryukyu Is; winters S to S Iraq, S India and SE Asia.

M. m. formosanus Nagamichi Kuroda, 1920 - Taiwan and Hainan (S China).
M. m. govinda Sykes, 1832 - E Pakistan E through India and Sri Lanka to Indochina and Malay Peninsula.
M. m. affinis Gould, 1838 - Sulawesi and possibly Lesser Sunda Is; E New Guinea and New Britain; N Australia S (in E) to Victoria.
M. m. aegyptius (Gmelin, 1788) - Egypt, SW Arabia and coastal E Africa S to Kenya.
M. m. parasitus (Daudin, 1800) - Africa S of Sahara, Cape Verde Is, Comoro Is and Madagascar.



Descriptive notes. 55-60 cm; 567-941 g; wingspan 135-155 cm. Mostly reddish brown; tail brown and only slightly forked. Juvenile generally paler and more heavily marked, with more contrasted pattern. Races vary most notably in bill colour; also in plumage and size.

Habitat. Ubiquitous, occurring from semi-desert, grassland and savanna to woodland, but avoids dense forest: wooded areas particularly important for nesting and roosting. Commonly aquatic habitats, e.g. rivers, lakes, wetlands, seashores and nearby in meadows and along margins of wetlands. Often linked with man to greater or lesser degree, frequenting suburbs,

harbours, villages, nomads' camps; has colonized, extremely successfully, large urban areas of Africa and Asia, e.g. Karachi (Pakistan). Normally in lowlands, but sometimes forages, and may breed, above 2000 m; even recorded on occasion foraging at around 4000 m, in Himalayas. Gregarious, sometimes roosting communally, mainly in trees.

Food and Feeding. Very adaptable; has become extensively commensal with man. Feeds on wide variety of animal remains, e.g. offal from abattoirs or fisheries, garbage, scraps, any kind of carrion. Also catches live prey: mammals, e.g. voles and other small rodents, moles, young rabbits and hares, bats; small birds, both terrestrial and aquatic, often juveniles, including chicks of domestic poultry; also fish, lizards, amphibians and invertebrates, e.g. grasshoppers, locusts, crickets, beetles, termites, flying ants, earthworms, crustaceans and molluscs. Fish often important in diet, normally dead or disabled, and especially small fish; invertebrates can be important locally or seasonally. More unusually, vegetable matter, particularly oil palm fruits. Catches prey on ground or water: large insects caught in air, and then eaten on wing. Often forages around margins of water bodies, and by refuse dumps, slaughterhouses or roads, where looks for animals knocked down by traffic. Flies up to 30+ km from roosts; slow, fairly low surveying flight, very agile and manoeuvrable; skilful, shameless urban scavenger, taking food from markets or busy streets; also steals from other raptors and other birds.

Breeding. Laying dates very variable, due to vast size of range: in temperate zones of Eurasia, Mar/Apr-Jun; in tropical Africa, normally in dry season; in S Africa, normally Aug-Dec; in Australia, variable, but mainly Jul-Nov in S. Solitary or loosely colonial, up to tens of pairs together. Normally nests in trees (broad-leaved, coniferous, palms), building nest in fork or on branch; also on cliff ledges, locally along coast, on buildings (e.g. Egypt, India) or on pylons. Nest, or nest-site at least, reused annually; stick nest lined with materials such as rags, plastic, paper, dung or skin. Normally 2-3 eggs (1-4), laid at intervals of 1-2 days; incubation 26-38 days, normally by female almost exclusively; if male brings sufficient food, female may not hunt during entire breeding attempt; fledging 42-50 days; young independent c. 15-36 days later. Up to 4 young per nest fledge, but usually only 1; average 0.9-1.2 per breeding pair. First breeding sometimes in first year. Oldest recorded bird 23 years.

Movements. Mainly migratory; at least, shows certain nomadic or dispersive tendency after breeding. Nominate *migrans* markedly migratory, wintering mainly in sub-Saharan Africa (S to South Africa), and to lesser extent in Middle East; *lineatus* also migratory, although only partially, or even resident, in China and Japan, but some wintering from SE Asia and Indian Subcontinent, W to Middle East. Race *govinda* makes movements to avoid monsoon, and depending on food availability; *parasitus* shows complex pattern, influenced, like *govinda* and *affinis*, by seasonal rains, with South African populations migrating N after breeding; *aegyptius* mainly resident, although appears S to Kenya and Tanzania outside breeding season. Race *affinis* has resident, partly migratory and irruptive populations; status of birds in Lesser Sunda uncertain, perhaps only vagrants from Australia. Migrates in flocks and gathers to cross sea straits; 40,000-60,000 birds in post-breeding migration at Gibraltar each year; 36,690 recorded in spring 1980 at Elat (Israel).

Status and Conservation. Not globally threatened. CITES II. One of commonest of all diurnal raptors, and regionally the commonest, e.g. in Japan and probably in Africa. Favoured by adaptability and also tolerance of man, although has suffered due to shooting and especially poisons, pesticides and chemical pollution of water; in decline over wide area, notably in most of Europe, former USSR and N Africa. Still abundant in much of range, e.g. sub-Saharan Africa and Indian Subcontinent, where c. 2400 pairs in Delhi alone in late 1960's; however, estimates of population sizes mostly lacking. In 1980's perhaps c. 20,000-24,000 pairs in Europe (excluding former USSR), including c. 9000 in Spain and 5800-8000 in France; in early 1990's, perhaps c. 60,000 pairs in European Russia and 500-600 pairs in Byelorussia; still fairly common, but declining throughout Ukraine. In Israel, in early 1970's, recolonization as breeder, and particularly as winter visitor, following extirpation due to agricultural pesticide poisoning in 1950's.

Bibliography. Ali & Ripley (1978), Baker-Gabb (1984), Bell (1985), Bergier (1987), Brazil (1991), Brooke (1974), Brown *et al.* (1982), Bustamante (1990), Bustamante & Hiraldo (1989, 1990, 1993), Cramp & Simmons (1980), Delibes (1975), Dementiev & Gladkov (1951), Desai & Malhotra (1977, 1979), Coates (1985), Espina (1982), Etchécopar & Hue (1978), Feng Wen-he (1965), Ficuzynski (1981), Ficuzynski & Wendland (1968), Flint *et al.* (1984), Günsbol (1986), Ginn *et al.* (1989), Glutz von Blotzheim *et al.* (1971), Goodman *et al.* (1989), Gore (1990), Grimes (1987), Handrinos & Demetropoulos (1983), Haneda & Koizumi (1965), Hiraldo *et al.* (1990), Hollands (1984), Knysatunas (1993), Koga & Shiraiishi (1987), Koga *et al.* (1989a, 1989b, 1989c), Kuhlman (1981, 1987), Langrand (1990), Lavery & Johnson (1993), Macdonald (1980b), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Makatsch (1953), Marchant & Higgins (1993), Meyburg (1966, 1967), Milon *et al.* (1973), Olsen & Marples (1993), Pakenham (1979), Paz (1987), Roberts (1991), Rogacheva (1992), Salheesun (1989a, 1989b, 1989c, 1990a, 1990b), Schifferli (1967), Shirihai & Christie (1992a, 1992b), Shirihai & Yekutieli (1991), Simeonov *et al.* (1990), Smythies (1986), Sunyer (1983), Sylven (1977a, 1977b), Thollay (1976b, 1978c, 1989c), Veiga & Hiraldo (1990), Viñuela (1991, 1993), Viñuela & Sunyer (1992).

Genus HALIASTUR Selby, 1840

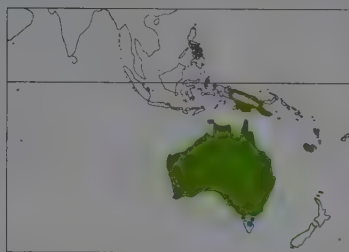
32. Whistling Kite

Haliastur sphenurus

French: Milan siffleur **German:** Keilschwanzweih **Spanish:** Milano Silbador
Other common names: Whistling Eagle/Hawk

Taxonomy. *Milvus sphenurus* Vieillot, 1818, New South Wales.

Placed in genus *Milvus* by some authorities, but differs in plumage, voice and behaviour. Monotypic.
Distribution. Australia, New Caledonia, and New Guinea (except NW and central mountains).



Descriptive notes. 51-59 cm; 380-1050 g; wingspan 123-146 cm. Similar to juvenile *H. indus* but has longer primaries and tail. Female larger and heavier than male. Juvenile heavily streaked and spotted. Larger in S than in tropics.

Habitat. Lightly wooded and open habitats, typically near or over terrestrial and marine wetlands; from sea-level to 1400 m. Nests in woodland, often riparian.

Food and Feeding. Variety of small animals and carrion, including mammals, birds, reptiles, fish, crustaceans, insects, road-killed vertebrates, large carcasses and offal. Forages by

quartering and high soaring; drops on prey, hawks flying insects, snatches prey from water surface. Patrols roads, and fronts of grass fires; robs other raptors.

Breeding. Season long and variable; most of dry season (austral autumn to spring) in tropics; usually late winter and spring in S. Solitary, but sometimes near raptors of other species. Platform of sticks 60-150 cm wide, 30-100 cm deep, lined with green leaves; placed 3-62 m above ground in fork of live or dead tree. Usually 2 eggs (1-4); incubation 35-38 days; chicks have cream or fawn down; fledging 44-54 days; post-fledging dependence 6-8 weeks. Oldest ringed bird 11 years. Success variously measured as: 60% hatching success, and 1.0 young per nest; 1.5 young per clutch started, and 1.3 young fledged per pair per year; and 96% fledging success in nests with young.

Movements. Partly migratory and dispersive within Australia. Migratory in S and SE, wintering in milder coastal and N areas; some birds resident in both temperate and tropical areas.

Status and Conservation. Not globally threatened. CITES II. Common to abundant on coasts, and in tropics where benefits from human activity; locally declining in S through drainage of wetlands and reduction in food supply. Eggshell thickness significantly reduced by DDT use in S agricultural areas (use now curtailed); some birds poisoned.

Bibliography. Baker-Gabb (1984a), Beehler *et al.* (1986), Bell (1985), Coates (1985), Cupper & Cupper (1981), Debus (1983a), Gilliard & LeCroy (1966), Hannecart & Létocart (1980), Hollands (1984), Klapste (1983), Marchant & Higgins (1993), Martin, K. (1992), Newgrain *et al.* (1993a), Olsen (1991), Olsen & Marples (1992, 1993), Olsen & Olsen (1987a), Olsen, Crome & Olsen (1993), Olsen, Fuller & Marples (1993), Schodde & Tidemann (1986), Sontler (1987).

33. Brahminy Kite

Haliastur indus

French: Milan sacré **German:** Brahminenweih **Spanish:** Milano Brahmán
Other common names: Red-backed/White-headed Sea-eagle, Red-backed Kite, Whistling Eagle

Taxonomy. *Falco Indus* Boddaert, 1783, Pondicherry, India.

Placed in genus *Milvus* by some authorities, but differs in plumage, voice and behaviour. Four subspecies recognized.

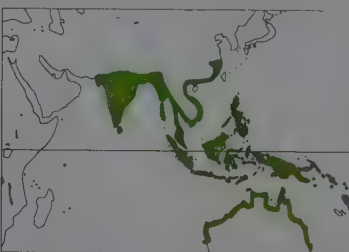
Subspecies and Distribution.

H. i. indus (Boddaert, 1783) - Pakistan, India and Sri Lanka through SE Asia to S China.

H. i. intermedius Blyth, 1865 - Malay Peninsula, Greater and Lesser Sundas, Sulawesi and related small islands, Philippines and Sula Is (C Moluccas).

H. i. girrenera (Vieillot, 1822) - Moluccas, New Guinea, Bismarck Archipelago and Australia.

H. i. flavirostris Condon & Amadon, 1954 - Solomon Is.



Descriptive notes. 45-51 cm; 320-673 g; wingspan 109-124 cm. Adult unmistakable. Female larger and heavier. Juvenile streaky brown; similar to *H. sphenurus*, but with shorter wings and tail. Regional variation in plumage and bill colour: Australasian races have pure white head and breast; Solomon Is birds have yellow bill.

Habitat. Coasts, estuaries, terrestrial wetlands and urban areas; in tropics ranges over forest, farmland and grassland far from water; from sea-level to 1800 m (to c. 2000 m in WC Sumatra). Nests in trees, often mangroves, near water; occasionally on artificial structures.

Food and Feeding. Variety of small animals and carrion, including mammals, birds, reptiles, amphibians, fish, arthropods, crustaceans, shellfish, cuttlefish, road-killed vertebrates, large carcasses and offal; sometimes domestic poultry. Forages by quartering and high soaring, or still-hunting from prominent perch; sometimes searches on ground. Seizes prey by glide or dive that may become short chase; hawks flying insects, snatches prey from tree canopy and water surface, and robs other predators.

Breeding. Dry season in tropics, late winter and spring in subtropics. Solitary. Platform of sticks and other flotsam 40-60 cm wide, up to 20 cm deep, lined with leaves and other soft material including human rubbish; placed 2-30 m above ground in tree or artificial structure. Usually 1-2 eggs (1-4); incubation c. 35 days (28 days in Bangladesh), by female; chicks have cream to fawn down; fledging c. 50-56 days (40-44 days in Bangladesh). Age at first breeding probably at least 2 years. Usually 1 young raised to fledging, sometimes 2, occasionally 3; of 6 recorded nests, 3 successful (each producing 1 young). In Bangladesh, 63-33% success for eggs hatched.

Movements. In Australia and Asia mostly resident, with some local movement; congregates round abundant food. Breeding pairs sedentary. Occasional visitor to N Vanuatu.

Status and Conservation. Not globally threatened. CITES II. Common to abundant and widespread in tropics, where benefits from human activity. Range contracting northwards in E Australia, where eggshell thickness significantly reduced by DDT use (now ceased), and population affected by habitat disturbance. Has undergone dramatic decline throughout Java, with several possible causes: excessive use of pesticides; hunting pressure, for stuffing; collection of nestlings for sale in markets; loss of nesting habitat; and perhaps decreased food availability, with improved urban hygiene. Also declining in non-coastal parts of Thailand.

Bibliography. Ali & Ripley (1978), Baker (1935), van Balen *et al.* (1993), Beehler *et al.* (1986), Bell (1985), Bregulla (1992), Cheng Tso-hin (1987), Coates (1985), Coomans de Ruiter (1947), Cupper & Cupper (1981), Debus (1992), Dickinson *et al.* (1991), Etchécopar & Hue (1978), Henry (1971), Hollands (1984), Lekagul & Rund (1991), MacKinnon (1988), MacKinnon & Phillips (1993), Marchant & Higgins (1993), van Marle & Vosous (1986), Medway & Wells (1976), Olsen (1991), Olsen & Marples (1993), Olsen, Crome & Olsen (1993), Olsen, Fuller & Marples (1993), Roberts (1991), Schodde (1977), Schodde & Tidemann (1988), Smith, J.I.D. (1992), Smythies (1981, 1986), White & Bruce (1986).



34



35



36



37



38



39



40



41



dark form "niger"



42



43

PLATE 6

inches 12
cm 30

Genus *HALIAEETUS* Savigny, 1809

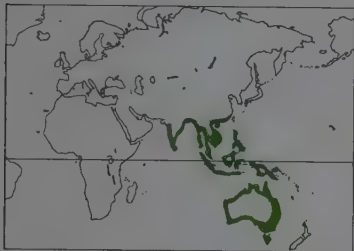
34. White-bellied Sea-eagle

Haliaeetus leucogaster

French: Pygargue blagre German: Weißbauch-Seeadler Spanish: Pigargo Oriental
Other common names: White-breasted Fish-eagle/Sea-eagle

Taxonomy. *Fulco leucogaster* Gmelin, 1788, no locality = Java. Forms superspecies with *H. sanfordi*. Monotypic.

Distribution. India and Sri Lanka through SE Asia, Philippines, Wallacea, New Guinea and Bismarcks to Australia and Tasmania.



Descriptive notes. 75-85 cm; male 2120-2900 g, larger female 2900-3400 g; wingspan 180-218 cm. Adult unmistakable. Juvenile mottled brown with white tail, which distinguishes it from dark-tailed adult and juvenile *H. sanfordi*. **Habitat.** Inshore seas and islands, coasts, estuaries and terrestrial wetlands, ranging over nearby wooded and open habitats; from sea-level up to 1400 m, or to 1700 m on Sulawesi. Nests in forest, woodland and rocky areas.

Food and Feeding. Mammals, birds, reptiles, fish, carrion and tideline offal. Live prey includes rabbits, fruit-bats (*Pteropus*), waterfowl and seabirds to size of gull, cormorant and gan-

net; takes spiny and poisonous fish and sea snakes. Forages by quartering, high soaring or still-hunting from perch. Attacks by shallow glide or dive to snatch prey from ground or water surface; harries aquatic birds to exhaustion, snatches fruit-bats from tree roosts, robs other predators, and attends foraging dolphins.

Breeding. May-Sept in Australia (May-Aug in N, June-Sept in S, where exceptionally to Nov); dry season in Asia and tropics. Solitary. Platform of sticks 120-170 cm wide, 50-180 cm deep, lined with leaves, grass and seaweed; placed on ground or cliff on offshore islands, otherwise 3-40 m above ground in tree. Usually 2 eggs (1-3); incubation c. 40 days; chicks have white down; fledging 65-70 days. Age at first breeding 7 years in captivity; not before assumption of adult plumage (at c. 5 years) in wild. Success in S Australia: 1-3 young per successful nest, 1-1 per active nest, 0-8 per occupied territory per year; 34% of successful nests raised 2 fledglings, 66% raised 1.

Movements. Breeding adults sedentary, juveniles dispersive. Some movement forced when inland waters dry up. Sometimes follows large rivers for some considerable distance inland.

Status and Conservation. Not globally threatened. CITES II. Generally common, though some localized declines in S Australia through habitat destruction or disturbance to nest-sites; also declining in Thailand. May have benefited from introduced prey and rubbish dumps in some areas. Eggshell thickness significantly reduced by DDT use in Australia (use now ceased).

Bibliography. Ali & Ripley (1978), Baker (1935), Bechler *et al.* (1986), Bilney & Emison (1983), Brown, L.H. (1976b), Cheng Tso-hin (1987), Coates (1985), Cupper & Cupper (1981), Dharmakumarsinjhi & Lavkumar (1956), Dickinson *et al.* (1991), Emison & Bilney (1982), Etchecopar & Hùe (1978), Falkenberg *et al.* (1994), Favalaro (1944), Fleay (1948), Gilliard & LeCroy (1966), Green (1959), Henry (1971), Hollands (1984), Lindgren (1972), MacKinnon (1988), Marchant & Higgins (1993), van Marle & Voous (1988), Medway & Wells (1976), Olsen & Marples (1993), Olsen, Crome & Olsen (1993), Olsen, Fuller & Marples (1993), Rhodes (1959), Saunders (1957), Schodde & Tidemann (1988), Smith, G.C. (1985), Smythies (1981, 1986), Tarr (1962), White & Bruce (1986).

35. Sanford's Sea-eagle

Haliaeetus sanfordi

French: Pygargue de Sanford German: Salomonenseadler Spanish: Pigargo de las Salomón
Other common names: Solomons/Brown Sea-eagle

Taxonomy. *Haliaeetus sanfordi* Mayr, 1935, Choiseul Island, Solomons.

Has been confused with, or considered a race of, *H. leucogaster*, with which it forms superspecies; separated by plumage. Monotypic.

Distribution. Solomon Is, including Bougainville I and Buka I.



Descriptive notes. 70-90 cm; female 2270-2725 g. Adult similar to juvenile *H. leucogaster*, but more uniform, with pale buff head and dark eyeline, tawny underparts and dark tail; pale area on median coverts. Female larger than male. Juvenile mottled brown, similar to juvenile *H. leucogaster* but with dark tail and darker underwing.

Habitat. Occurs from inshore water and tideline to montane rain forest near freshwater lakes (1500 m), mostly over coastal habitats. Reputedly nests in hill forest, but pair also seen courting over mangroves of coastal islet.

Food and Feeding. Much like other *Haliaeetus*, contrary to reports that it is more of a forest eagle. Mostly fish and tideline offal; also cuscus (*Phalanger*), fruit-bats (*Pteropus*) and reportedly birds such as pigeons. Patrols or perches overlooking coastline; takes fish and fish discards from water surface in manner of other sea-eagles; scavenges on beaches. Arboreal prey apparently snatched from forest canopy.

Breeding. Courtship in Aug. No first-hand ornithological observations of breeding, but a large stick nest in a forest tree was said by natives to belong to this species.

Movements. Unknown. Adults presumably sedentary, as inferred from isolation, morphology and lack of records outside normal range.

Status and Conservation. Not globally threatened. CITES II. Range and total population size small, biology little known; species formerly considered threatened. Moderately common locally in undisturbed habitats where not persecuted; scarce or absent where subject to hunting or deforestation. Possibly subject to breeding failure through eggshell thinning where DDT used, but data lacking.

Bibliography. Blaber (1990), Brown, L.H. (1976b), Brown & Amadon (1968), Coates (1985), Collar & Andrew (1988), Fentzloff (1989, 1990), Hadden (1981), Mayr (1935, 1936, 1945a), Schodde (1977).

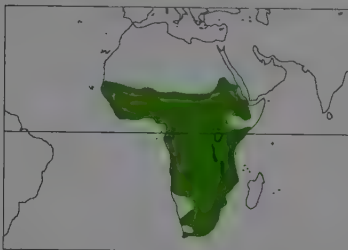
36. African Fish-eagle

Haliaeetus vocifer

French: Pygargue vocifère German: Schreiseeadler Spanish: Pigargo Vocinglero
Other common names: Fish/River Eagle

Taxonomy. *Falco vocifer* Daudin, 1800, Keurboom River, Cape Province, South Africa.

In past, frequently placed in genus *Cuncuma*. Forms superspecies with *H. vociferoides*. Monotypic. **Distribution.** Sengambia E to Ethiopia and S to South Africa.



Descriptive notes. 63-73 cm; male 1986-2497 g, female 3170-3630 g; wingspan 190 cm. White on head and breast more extensive in female; this coloration is also main difference from Madagascar *H. vociferoides*. Loud yelping calls, uttered with head thrown back while perched or in flight, often by pair in duet, synonymous with African waterways. Juvenile mottled brown, black and white, with a distinct intermediate plumage before adult at about 5 years old.

Habitat. Margins of large lakes, rivers, swamps and reservoirs; visits seashores in vicinity of estuaries and ranges up to 4000 m; will sometimes breed at such sites.

Food and Feeding. Mainly fish of 200-1000 g, but up to 4200 g. Also takes carrion, waterbirds (especially young of colonial species), small mammals, reptiles (e.g. monitor lizards, terrapins or crocodiles), amphibians, and even insects; whatever is necessary or locally vulnerable. Hunts mainly from a perch by swooping down to pluck prey from near the surface, "rowing" larger prey to shore. Rarely hunts when soaring, but regularly pursues and pirates other piscivorous birds. Perches for 85-95% of day in productive tropical habitat. Usually solitary but over 100 may gather at concentrations of stranded fish.

Breeding. May lay in any month in most regions, but locally seasonal and generally favours low-water conditions, with peak in Oct-Dec/Jan in W Africa; Jul-Oct in Uganda; Jun-Aug in S Africa. Builds large stick nest in high fork of tree as close to water as possible, rarely on cliff or steep slope. Usually 2 eggs (1-4); incubation 42-45 days; chicks have white down; fledging 65-75 days; often only 1-2 chicks survive to independence, about 2 months after fledging.

Movements. Resident around many permanent waterbodies, usually as territorial pairs. However, rapidly colonizes new or ephemeral habitat, as in E Namibia, and some post-breeding dispersal, as in Kenya, suggesting mobile non-breeding sector of population. Juveniles often congregate in areas away from territorial adults. Vagrant to N Egypt (Sinai).

Status and Conservation. Not globally threatened. CITES II. Common on many major rivers and lakes, often at high densities for such a large predator, needing only 300-600 m of shore per pair, or 3-15 ha of fishing area; at lower densities along forested rivers (10-20 km per pair in Gabon). Locally vulnerable to river degradation and hunting (e.g. Ivory Coast), but also adaptable through flexible feeding habits and rapid exploitation of new impoundments or prey. Known to be contaminated with pesticides in some areas of Zimbabwe and South Africa, but no obvious population effects.

Bibliography. Benson & Benson (1975), Brosset & Erard (1986), Brown, L.H. (1976b, 1980), Brown & Cade (1972), Brown & Hopcraft (1973), Brown *et al.* (1982), Cramp & Simmons (1980), Culverwell (1985), Davies & Randall (1989), Douthwaite (1992), Geldenhuys (1984), Ginn *et al.* (1989), Gore (1990), Grimes (1987), Hines & Raats (1989), Lewis & Pomeroy (1989), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Morgan (1979), Pakenham (1979), Pickford *et al.* (1989), Pinto (1983), Prout-Jones & Milstein (1986), Smart (1991), Steyn (1960, 1972b, 1982), Sumba (1986, 1988, 1989), Sumba & Pomeroy (1984), Tarboton & Allan (1984), Thiollay (1981, 1985d), Thiollay & Meyer (1978), Thomson (1984), Whitfield & Blaber (1978).

37. Madagascar Fish-eagle

Haliaeetus vociferoides

French: Pygargue de Madagascar German: Madagaskarseadler Spanish: Pigargo Malgache
Other common names: Madagascar Sea-eagle

Taxonomy. *Haliaeetus* [sic] *vociferoides* Des Murs, 1845, Madagascar.

Forms superspecies with African *H. vocifer*. Monotypic.

Distribution. Madagascar; originally in all W coast regions, and possibly on E coast, but now confined to NW coast. May also have extended to Mauritius historically.



Descriptive notes. 70-80 cm; wingspan 200 cm. White tail against overall brown plumage distinctive; sharply defined white mask with dark streak through eye. Sexes similar. Juvenile duller brown with dark terminal band to tail. Much duller than African congener *H. vocifer* but with similar distinctive vocal display.

Habitat. Shores of seas, lakes and large rivers, favouring rocky offshore islands and wooded perimeters, including mangroves; occurs up to 1200 m. Now mainly coastal.

Food and Feeding. Mostly surface-dwelling fish, including introduced *Tilapia*, and some crabs. Hunts from perches over water and

roosts in tall trees near the shore. Spends long periods perched interspersed with some soaring high over territory. Plunge-dives to take prey from water surface. Attacks, and probably pirates prey from other waterbirds. Usually encountered in pairs.

Breeding. Laying Jun-Jul. Builds large stick nest, lined with green leaves, on an island cliff, mangrove or tree near water. Usually 2 eggs; incubation c. 41 days; fledging c. 120 days; chicks have white down; elder chick may eliminate its younger sibling.

Movements. None recorded; range now much reduced. Previous records from E coast and Mauritius suggest considerable dispersion.

Status and Conservation. ENDANGERED. CITES II. Only 45-50 breeding pairs at 48 occupied territories estimated in 1985; some pairs with mean inter-nest distance of 1-48 km. More intensive recent surveys (1992) indicate twice the previous known density in S part of range (21 pairs, as opposed to 10); maximum total may be c. 100 pairs. Appears to have been recorded from all

W coastal regions until about 1940, and was still reported regularly in SW until 1975. Now restricted to 600 km of shoreline and to rocky islands and lakes in the Antsalova region, between Antsiranana and Belo-sur-Mer. Exact reasons for decline remain uncertain. Persecution of adults and nests remains a problem; not found to be affected by pesticides, but degradation of waterbodies through deforestation and poor agricultural practices leading to soil erosion in catchment areas may be a primary concern.

Bibliography. Collar & Andrew (1988), Collar & Stuart (1985), Dee (1986), Delacour (1932), Ferguson-Lees & Faull (1992), King (1978/79), Langrand (1987, 1990), Langrand & Meyburg (1984, 1989), Meyburg (1979a), Milon *et al.* (1973), Rand (1936), Salvan (1971), Thiollay & Meyburg (1981), Watson, Berkelman *et al.* (1993).

38. Pallas's Fish-eagle

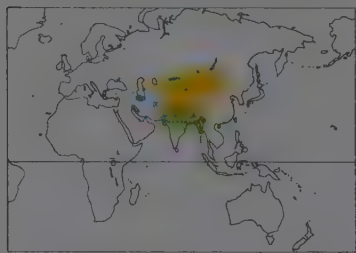
Haliaeetus leucoryphus

French: Pygargue de Pallas **German:** Bindenseeadler **Spanish:** Pigargo de Pallas
Other common names: Ring-tailed/Band-tailed Fishing-eagle

Taxonomy. *Aquila leucorypha* Pallas, 1771, lower Ural river.

Monotypic.

Distribution. C & S Asia, from Kazakhstan (possibly extinct) to Mongolia and NE China, S to Pakistan, N India, Burma and SC China (Sichuan).



Descriptive notes. 72-84 cm; 2040-3700 g; wingspan 180-205 cm. Mainly brown plumage, with head and neck golden sandy buff; rounded tail dark brown with conspicuous broad white band. Female somewhat larger than male. Juvenile more uniformly brown, including all of tail, but has pale band on underwing-coverts and pale panel on inner primaries.

Habitat. Rivers and lakes, freshwater wetlands and pools; often in arid areas or steppe. In winter, may visit inland seas. Present in high plateaus and valleys, reaching 5200 m in Tibet.

Food and Feeding. Mainly fish; also waterbirds, rodents, lagomorphs, frogs, reptiles

(snakes, turtles) and carrion; even human bodies on occasions. Fish caught near surface, without plunge; alternatively taken as carrion; also steals from Ospreys (*Pandion haliaetus*) and other birds. Chicks of waterbirds sometimes stolen from colonies.

Breeding. Laying Oct-Feb in N India; later further N, formerly Mar in Kazakhstan and May in Tibet. Both adults build enormous nest of sticks and branches, lined with fresh leaves; normally in large tree near water, but, if necessary, can be built in reedbeds or on ground; same nest reused repeatedly. Normally 2-3 eggs, sometimes 4; incubation c. 40 days, mainly by female; chicks have first down brownish grey, second down greyish brown, long and woolly; chicks fed by both adults; normally maximum of 2 chicks raised to fledging.

Movements. Sedentary and dispersive, although mainly migratory in N, particularly where inland waters frozen over for long periods. Migrants reach Afghanistan, Iran and formerly Iraq; also very probably to Indian Subcontinent and Burma, where local populations basically sedentary.

Status and Conservation. RARE. CITES II. Formerly much more widespread; in first half of present century, breeding range stretched to Caspian Sea, where species last bred in 1947. Appears to have undergone a general decline, for causes that are not fully understood. Breeding population of former USSR may now be extinct; found only in Kazakhstan in 20th century. Scarce information available on status in Burma, Mongolia and China. Rare in Pakistan, with less than 40 pairs estimated in 1974; in rapid decline in Bangladesh; apparently more common in India, but fairly local.

Bibliography. Ali & Ripley (1978), Borodin (1984), Brown, L.H. (1976b), Cheng Tso-hin (1987), Collar & Andrew (1988), Cramp & Simmons (1980), Dementiev & Gladkov (1951), Etchécopar & Hüe (1978), Flint *et al.* (1984), Günsel (1986), Inskipp & Inskipp (1985), Knyshtaus (1993), Liu Tsomo (1990), Love (1983), Mauersberger *et al.* (1982), Meyer de Schauensee (1984), Nanjappa (1989), Paz (1987), Patrikeev (1993), Roberts (1991), Sarker & Iqbal (1985), Smythies (1986).

39. White-tailed Sea-eagle

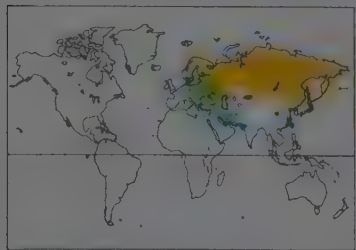
Haliaeetus albicilla

French: Pygargue à queue blanche **German:** Seeadler **Spanish:** Pigargo Europeo
Other common names: White-tailed Eagle

Taxonomy. *Falco Albicilla* Linnaeus, 1758, Sweden.

Forms superspecies with *H. leucocephalus*. Birds from Greenland sometimes separated in race *groenlandicus*, on grounds of larger average size. Monotypic.

Distribution. SW Greenland; W Iceland; N & C Eurasia S to Greece and Turkey, S Caspian Sea, L Balkash and Manchuria; formerly to lower R Yangtze; has bred on Attu I (W Aleutian Is). Winters S to N Mediterranean, Persian Gulf, Pakistan, N India and SE China.



Descriptive notes. 69-92 cm; male 4100 g, female 5500 g; wingspan 200-245 cm. White tail and yellow bill as in *H. leucocephalus*, but head and neck pale buff rather than pure white, contrasting much less with rest of plumage; upperparts fairly pale, wing-coverts and upper back yellowish brown; tail wedge-shaped. Female averages larger. Juvenile blackish brown, with tail, head, bill and iris all dark; whitish markings on axillaries; gradually attains adult plumage over 5-6 years, but tail not white until 8th year; bill yellow after 4-5 years.

Habitat. Diverse aquatic habitats, both freshwater and marine; coasts, rocky islands, lakes,

large rivers and large marshes. From desert to Arctic climates. For nesting and roosting requires proximity of sea cliffs or woods, ideally with high trees. Rarely far from coast or large stretches of water; normally in lowlands.

Food and Feeding. Wide range of food types, including fish, birds and, less importantly, mammals; prey normally medium-sized. Fish probably main prey in many areas; some taken dead or dying, rest normally caught without plunge; species which swim near surface most important, e.g. lump-sucker (*Cyclopterus lumpus*) and Gadidae at sea, pike (*Esox lucius*) in fresh water. Avian prey mainly seabirds and waterbirds; particularly species that dive, which are attacked on water, sometimes being chased to exhaustion by pair of eagles (see page 71); during breeding often steals chicks and

sometimes eggs from colonies, particularly of eiders and other Anatidae, auks, shags, gulls and coots. Mammals include rodents, rabbits and hares, and ungulates (sheep, goats and deer); almost exclusively taken as carrion, although young individuals sometimes hunted. Also steals from birds, e.g. Ospreys (*Pandion haliaetus*), other birds of prey, cormorants. Has learnt to take offal from fishing boats, and enjoys easy fishing in fish-breeding ponds.

Breeding. Laying dates vary considerably with latitude: Jan in S of range; Apr-May in Arctic regions. Nests mainly on ledges of sea cliffs or on high trees, rarely on ground; tree-nest placed in fork or touching trunk. Each pair normally has 2-3 nests, which are used alternately; enormous structures of sticks and branches, which in time can become several metres deep and wide; cup lined with materials such as moss, grass, lichens, ferns, seaweed or wool. Usually 2 eggs (1-3), laid at interval of 2-4 days; incubation 38 days (perhaps 34-46) per egg, starting with first egg; adults share incubation and care of young; chicks have first down grey, second down grey-brown; fledging 70-90 days; young depend on adults at least 30 days more. Breeding failure can be very high: 1-2 (very occasionally 3) chicks fledge, with averages of 0.2-1.1 per breeding pair, and 1.1-2.0 per successful pair. Low juvenile mortality. Sexual maturity at 5 years old, maybe younger. Can live to 27 years old (42 in captivity).

Movements. Mainly migratory in N and E of breeding range; sedentary elsewhere, including Greenland, Iceland and Norway. Juveniles more dispersive and gregarious; in winter can form flocks of 10's of birds (even 100) in good feeding or roosting areas, e.g. 72 on Hortobágy Plain, Hungary, in Dec 1993. In winter, straggles S from S Sweden through C Europe, rarely to S Europe; in Asia, movements poorly known, with birds occurring from Middle East to E China and Japan. Adults leave N breeding areas later (Oct) and return earlier (Feb-Apr) than juveniles.

Status and Conservation. VULNERABLE. CITES I. Marked decline historically from 19th century, with drastic reduction and extinction from extensive areas, including British Is, Faeroes, W Europe and most of Mediterranean. Trend reversed, with recolonizations in different periods of 20th century, becoming generalized from 1980's. By early 1990's, species on increase in most of Europe and stable or with slight increase in former USSR, but in decline and seriously threatened in SE Europe. Total numbers not accurately known, depending considerably on estimates from former USSR, with largest population of possibly 5000-7000 pairs. Figures available for early 1990's include: c. 1500 pairs in Norway; 1000 pairs in European Russia, where greatest density on lower Volga, with 250-300 pairs; 245+ pairs in Poland; c. 200 pairs in Germany; c. 100 pairs in Sweden; 80 pairs in Finland; 50-90 pairs in Byelorussia; and 50-60 pairs in Baltic republics. In 1980's; 160+ pairs in Greenland, and 30-40 pairs in Iceland. Asian populations little known, with maximum 20 pairs in Japan, and maybe 15-25 pairs in Turkey (1980's). Main causes of decline were direct persecution, use of poisoned baits and habitat destruction, especially drainage and forestry; from mid-20th century, seriously affected by pollution with organochlorine pesticides and heavy metals, particularly in Baltic, with significant reduction in breeding success. Recovery has been based on active protection, including guarding of nests and supply of uncontaminated food in winter; also favoured by drop in levels of some toxins. Threats continue to varying degrees, and habitat subject to tourist development and privatization of land for development. Various reintroduction projects successfully started: first breeding on Rhum (W Scotland) in 1985 and in S Bohemia in 1986; steady increase in breeding pairs, with 1988 totals of 11 in Scotland and 9 in Czechoslovakia; chicks have been successfully raised to fledging.

Bibliography. Ali & Ripley (1978), Altmeyer *et al.* (1991), Armstrong (1983), Baccetti *et al.* (1989), Belik (1988, 1993), Brazil (1991), Brazil & Hanawa (1991), Brown, L.H. (1976b), Brown *et al.* (1982), Cheng Tso-hin (1987), Christensen (1979), Collar & Andrew (1988), Cramp & Simmons (1980), Dementiev & Gladkov (1951), Dittmann *et al.* (1990), Etchécopar & Hüe (1978), Falandysz *et al.* (1987, 1988), Fentzloff & Minne Mann (1994), Finth (1976), Flint *et al.* (1984), Günsel (1986), Gothe (1989), Goodman *et al.* (1989), Groppl (1987), Handrinos & Demetropoulos (1983), Helander (1975, 1980, 1983, 1990a, 1990b), Kamp & Wille (1990), King (1978/79), Kjaran (1967), Knyshtaus (1993), Król (1983), Lever (1987), Liu Tsomo (1990), Love (1983, 1988), Love & Ball (1979), Love *et al.* (1978), Martin, B.P. (1992), Meyer de Schauensee (1984), Mizera & Szymkiewicz (1991), Mori (1980), Palmer (1988), Patrikeev (1993), Paz (1987), Piechocki *et al.* (1981), Roberts (1991), Rogacheva (1992), Simeonov *et al.* (1990), Stjernberg (1981), Stjernberg & Saurala (1983), Straka (1992), Tammur & Randla (1994), Ytrevog (1991b), Watson, Leitch & Broad (1992), Wille (1979), Wille & Kamp (1983), Willgoos (1963, 1984), Ytrevog (1992).

40. Bald Eagle

Haliaeetus leucocephalus

French: Pygargue à tête blanche **German:** Weißkopf-Seeadler **Spanish:** Pigargo Americano
Other common names: American Eagle, White-headed Sea-eagle

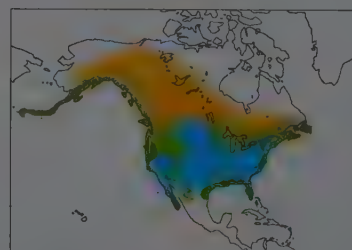
Taxonomy. *Falco leucocephalus* Linnaeus, 1766, America, Europe = South Carolina.

Forms superspecies with *H. albicilla*. Race *alascanus/alascensis* synonymous with *washingtoniensis*. Two subspecies recognized.

Subspecies and Distribution.

H. l. washingtoniensis (Audubon, 1827) - Aleutian Is, Alaska, Canada and N USA.

H. l. leucocephalus (Linnaeus, 1766) - S USA S to NW Mexico.



Descriptive notes. 71-96 cm; 3-6.3 kg; wingspan 168-244 cm. Adult dark brown with white head and tail. Female larger than male. Juvenile variable with age, all dark to mottled white to solid white belly; bill black, eye dark. Race *washingtoniensis* considerably larger.

Habitat. Generally prefers areas fringing water over considerable distance, e.g. coasts, estuaries, riparian habitats and lakes. From tundra (Aleutian Is) and conifer forests, to mangrove and cypress swamps (Florida), and even deserts (Mexico). In winter, also frequents arid sagebrush steppe and deserts far from water.

Food and Feeding. Great variation: carrion,

fish, birds, mammals, reptiles, invertebrates and garbage. In summer, largely fish and birds (e.g. seabirds, waterfowl), but reptiles can be important locally. During winter, mammals and carrion become important. Healthy birds caught; sometimes goose-size birds taken on the wing. Some auditory hunting; attracted to calls of prey (e.g. sea otters) out of visual field.

Breeding. Oct-Apr in S; Apr-Aug in N. Solitary; often aggregated, with small territories (20 ha). Nest location varied, depending on region, including ground, bluff, bush or tree, often on shoreline. If in tree, often placed on dead snag or at broken off top, conifer preferred over much of range. If on sea stack or hillside, usually easily accessible to humans. Often 2-4 unoccupied nests in territory. Nest may become huge (4 m deep, 2.5 m wide) with repeated use; central depression c. 10 cm deep lined with grass, seaweed or other vegetation. Usually 2 eggs (1-3, rarely 4). Incubation c. 35 days; chicks have dark grey down; fledging c. 70-92 days. Sexually maturity possibly at 4 years; will breed in year 4 but normally in year 5; few cases of successful breeding in years 3 (ringed birds) and 4. May form "breeding trios" of adults at nest-sites; in some populations c. 50% of adults are non-breeders. Oldest captive bird 47 years old, less in wild; first year mortality c. 75% in some

populations, and c. 10% reach year 5; adult mortality estimated at 6-8% in a stable population. Success varies regionally (data from 1970's and early 1980's): occupied territories 71%; successful territories 43%; successful nests 62%; hatching success 63-85% of attempts; 0-9 young fledged per occupied nest; 1-05 young fledged per active nest; 1-16 young fledged per successful nest. Fratricide occasionally occurs at 3-8 weeks.

Movements. In N: many resident on coast, and often large groups in coastal Alaska and British Columbia; inland, birds migrate Sept-Oct, arriving on wintering grounds in Nov, and some (with radio transmitters) known to move c. 2200 km. In S (e.g. California, Arizona and Florida), young birds move N in summer towards Canada, after fledging; adults in S may be sedentary.

Status and Conservation. Not globally threatened. CITES I. Complex situation: N populations not threatened and locally abundant, e.g. in coastal Alaska and British Columbia; but in lower Canada and most of contiguous 48 USA states, numbers reduced, and species often considered either threatened or endangered. Race *leucocephalus* listed as endangered in 1973, except in 5 states where listed as threatened. Bounty paid for eagles in Alaska in periods 1917-1945 and 1949-1953; c. 130,000-150,000 killed, and numbers there may still be recovering from that loss. Significantly affected by organochlorines in 1960's and 1970's, with losses of breeders of up to 50% in some areas, 90-100% in others; nesting failure 55-96%. Although DDT was banned, currently (1990's) lead poisoning is a problem in many areas. Numbers have increased in 1980's and 1990's, because of DDT ban, with 100-400% rise in breeders in some areas of W, e.g. Washington (from 99 to 398 pairs), Montana (22 to 93) and Idaho (12 to 53). Estimates of current populations are promising for some areas, poor in others: in early 1980's, total population estimated at c. 100,000 birds, based on Christmas bird counts, with over 60% in Alaska and British Columbia; certainly 10-15% more by 1990's. Because some regions have been relatively stable for past 2-3 decades (e.g. Saskatchewan), estimates from there are probably current; estimates for 1992 include c. 40,000-50,000 birds in Alaska, 20,000-30,000 in British Columbia, and c. 12,000 in Saskatchewan. In 48 contiguous states of USA, in 1993: c. 4016 breeding pairs, as opposed to 1188 pairs in 1980; 16,000 birds counted in winter, as opposed to 14,164 birds in 1980, although figures incomplete. No adequate surveys carried out in Mexico. In Jul 1994, proposal to reclassify in USA from endangered to threatened.

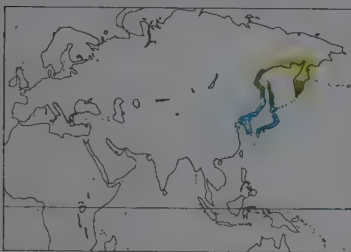
Bibliography. Anderson & Hickey (1972), Anthony *et al.* (1982), Bennett & Klaas (1986), Bird (1983), Bohm (1988), Bortolotti (1984), Brown, B.T. (1988), Campbell *et al.* (1990), Chandler *et al.* (1994), Clark, T.W. *et al.* (1989), Clark, W.S. (1983), Dugoni *et al.* (1986), Fielder (1982), Flath *et al.* (1991), Gerrard, J.M. & Bortolotti (1988), Gerrard, J.M. *et al.* (1992), Gerrard, P. *et al.* (1974), Gill & Kincheloe (1993), Grier (1982), Grubb *et al.* (1994), Hansen (1987), Hansen & Hodges (1985), Harmata & Stahlecker (1993), Harmata *et al.* (1985), Hunt, Driscoll *et al.* (1992), Hunt, Jackman *et al.* (1992), Johnson (1990), King (1978/79), Kjos (1992), Kussman (1976), Leighton *et al.* (1979), Lincer *et al.* (1979), Madsen *et al.* (1982), McClelland *et al.* (1980), McCollough (1989), Palmer (1988), Platt (1976a), Ritchie (1982), Sherrod, Estes & White (1975), Sherrod, White & Williamson (1976), Snow (1973a), Snyder & Wiley (1976), Sprunt *et al.* (1973), Stalmaster (1987), Steenhof (1983), Todd *et al.* (1982), Wagner *et al.* (1988), Wiemeyer *et al.* (1984), Wood *et al.* (1993).

41. Steller's Sea-eagle

Haliaeetus pelagicus

French: Pygargue empereur **German:** Riesenseeadler **Spanish:** Pigargu Gigante
Other common names: White-shouldered Sea-eagle

Taxonomy. *Aquila pelagica* Pallas, 1811, islands on sea of Okhotsk. Possible race "niger" of Korea is probably only rare morph; not known in wild or captivity for five decades. Monotypic.
Distribution. Coastal regions along W Bering Sea, S of Paul's Bay (Koryakland), and Sea of Okhotsk; winters S to Ussuriland, Japan and Korea.



Descriptive notes. 85-94 cm; 4900-9000 g. Unmistakable, due to immense size, blackish brown plumage with white shoulders and wedged-shaped tail; very deep, strongly arched yellow bill. Immature has more sharply wedged-shaped tail and heavier bill than young *H. albicilla*. Morph, or possible race, "niger" differs in being all black except for white tail.
Habitat. Narrow strips of coast, together with forested valleys along lower reaches of rivers. Always nests near water containing fish, hence concentrated near mouths of rivers, or along sea coast; alternatively on rivers where salmon run, or by lakes, provided they offer conditions

necessary for the building of bulky nests. Most often river valleys, where almost all nests are built in trees. Also rocky coasts with terraced cliffs 100 m high or more. Also nests on cliffs far inland.
Food and Feeding. Principally fish, especially Pacific salmon (Salmonidae), taken alive or dead. Remainder of diet highly varied, but plays a subordinate role, only becoming important at times when main food source in short supply. Habitual method of catching fish is for species to wait perched 5-30 m above water, on tree or rocky ledge, from which swoops down in a dive. Also circles 6-7 m above water and dives down; or stands in shallow water, on sandbank, spit or ice floe, from which catches prey.

Breeding. Laying generally in second half of Apr and early May; varies from region to region, depending largely on climatic conditions at end of winter and in spring, and also on availability of food. Large stick nest, up to c. 2.5 m wide and c. 4 m deep, in tree or on cliff. 1-3 eggs, usually 2 (56%); incubation c. 38-45 days; chicks have white down; fledging c. 70 days. Breeding success 0.51-0.55 young per pair per year. Usually only one young reared. Chicks often fall from nest, or with it, or succumb to disease.

Movements. Chief overwintering areas outside breeding range are in S Primorski region, Kuril Is and Sakhalin; many birds overwinter on Hokkaido, particularly on E coast. However, estimated that major part of Kamchatkan sub-population does not leave peninsula, but merely moves to S parts of it. A young bird tracked by satellite remained in nest area in Kamchatka for nearly 2 months after fledging, up to mid-Oct; within 3 weeks it migrated 1360 km S through Kuril Is to Urup, NE of Hokkaido.

Status and Conservation. RARE. CITES II. Total world population c. 7500 birds, including 5600 adults; majority (1200-1500 pairs) breed in Kamchatka; c. 2200 birds winter on Hokkaido. Main problems include habitat alterations, with large-scale destruction of old forests; shooting by hunters, and natural collapse of eysies. Conservation measures recommended include payment of compensation to hunters for skins damaged by eagles; populations must be thoroughly monitored in future.

Bibliography. Babenko *et al.* (1988a, 1988b), Bofau (1984), Brazil (1986, 1991), Brown, L.H. (1976b), Chernikin (1965), Collar & Andrew (1988), Dementiev & Gladkov (1951), Etchecopar & Hue (1978), Flint *et al.* (1984), Furukawa (1980), Kysenstam (1990), Lugin *et al.* (1991), Lavauzen (1974), Lobkov (1978, 1991), Lobkov & Neudicht (1986), Lobkov & Zueva (1983), Lobkov *et al.* (1988), Medvedev (1988), Meyburg & Lobkov (1994),

Nakagawa & Fujimaki (1988), Nakagawa *et al.* (1987), Nechnov (1988), Palmer (1988), Rostikov (1988), Shibuev (1987), Shibnev (1981), Shibnev & Trukhin (1988), Voronov (1988), Wunderlich (1980), Zukowsky (1966)

Genus *ICHTHYOPHAGA* Lesson, 1843

42. Lesser Fishing-eagle

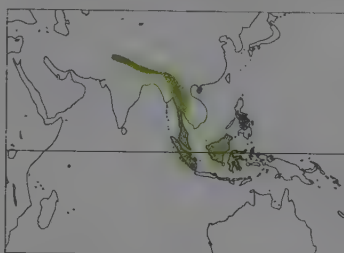
Ichthyophaga humilis

French: Pygargue nain **German:** Braunschwanz-Seeadler **Spanish:** Pigarguillo Menor
Other common names: Himalayan Grey-headed Fishing-eagle, Lesser Fish Eagle

Taxonomy. *Falco (Pandion) humilis* S. Müller and Schlegel, 1841, Sumatra. In past, frequently listed as *I. nana*, but name *humilis* has priority. Two subspecies recognized.
Subspecies and Distribution.

I. h. plumbea (Jerdon, 1871) - Kashmir SE through Himalayas of India and Nepal to Burma. N Indochina and Hainan.

I. h. humilis (S. Müller & Schlegel, 1841) - Malay Peninsula (from Tenasserim) and Sumatra through Borneo to Sulawesi and Banggai Is; recently recorded on Buru (S Moluccas).



Descriptive notes. 51-64 cm; 780-785 g; wingspan 120-123 cm. Small greyish brown fishing-eagle; differs from larger *I. ichthyaetus*, in lacking white base to tail. Juvenile browner, with lightly streaked to unmarked pale underparts. Races differ only in size; *plumbea* larger.
Habitat. Forested margins of fast-flowing streams and rivers in foothills and mountains; sometimes found in more open areas, especially around forested lakes. Occurs from 200 to 1000 m, but also near sea-level in some areas, e.g. on Sulawesi.

Food and Feeding. Almost exclusively fish. Catches fish by means of short Sally from

streamside perch, sometimes snatching it off surface of water. Spends much of time moving about between favoured perches; occasionally soars.

Breeding. Little studied. Season Nov-Mar in Burma; Mar-May in India and Nepal. Builds large stick nest in tall tree in forest, near river or stream. Adults quite vocal during courtship. Usually 2-3 eggs. No further information available.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES II. Apparently uncommon in Sulawesi, Borneo and Sumatra, but common in reserve of Padang-Sugihan (S Sumatra) in mid-1980's; said to be locally common along forested streams in Burma; probably relatively secure in all of these areas. However, declining in Nepal and India, probably as result of overfishing, or silting up of streams due to loss of streamside forests, or both; deforestation may also affect species directly through loss of nesting habitat. Three recent nesting attempts in N India were unsuccessful.

Bibliography. Ali & Ripley (1978), Andrew (1992), Bishop *et al.* (1994), Brown, L.H. (1976b), Cheng Tso-hin (1987), Deignan (1945, 1963), Inskipp & Inskipp (1985), King *et al.* (1975), Lekagul & Round (1991), van Marle & Voous (1988), Medway & Wells (1976), Mees (1967), Meyer de Schauensee (1984), Round (1988), Smythies (1981, 1986), Stresemann (1940a), White & Bruce (1986).

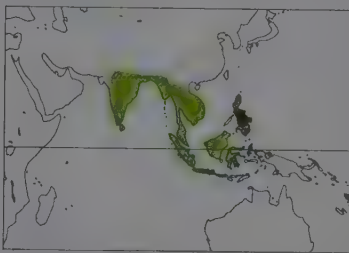
43. Grey-headed Fishing-eagle

Ichthyophaga ichthyaetus

French: Pygargue à tête grise **German:** Graukopf-Seeadler **Spanish:** Pigarguillo Común
Other common names: Greater Fish(ing) Eagle

Taxonomy. *Falco Ichthyaetus* Horsfield, 1821, Java. Population of Sri Lanka sometimes awarded separate race, *plumbeiceps*, which differs only in slightly smaller size; not normally accepted. Monotypic.

Distribution. India, Nepal and Sri Lanka E through Indochina and Malay Peninsula to Greater Sundas, N & E Philippines and Sulawesi.



Descriptive notes. 61-75 cm; 1600-2700 g; wingspan 155-170 cm. Medium-sized brownish grey fishing-eagle, with relatively small head and bill grey, and white belly; white base to tail. Darker and dusky than *I. humilis*. Juvenile brown, with underparts usually heavily streaked white; one specimen from Java was unstreaked.
Habitat. Lowland forests; closely associated with large bodies of fresh water, in particular sluggish streams, and large ponds; also rivers and marshes, and along sea coasts, sometimes near estuaries.

Food and Feeding. Almost exclusively fish; probably also some birds and small mammals. Catches fish from water surface by short flight

from hunting perch; fish too large to carry may be dragged to bank. Will also eat dead fish.

Breeding. Little studied. Season Dec-Mar in Sri Lanka; Nov-Jan in India; nests found in Jan and Mar in Burma; Apr in Sumatra. Builds huge stick nest 10-30 m up tall tree in forest, near lake or sluggish stream; nests used for several years in succession. Adults quite vocal during courtship. Usually 1-2 eggs, occasionally 3; incubation 28-30 days, by both sexes; fledging c. 10 weeks; fledgling dependency period unrecorded.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES II. Apparently fairly common in Sri Lanka; uncommon in Philippines, Borneo, Burma and Sumatra, but common in reserve of Padang-Sugihan (S Sumatra) in mid-1980's; generally rare and local in SE Asia and Sulawesi; widely but sparsely distributed in India; no recent records from Thailand or Java. Species seems to be secure, but locally numbers reduced or species extirpated, primarily through loss of forests.

Bibliography. Ali & Ripley (1978), Bishop *et al.* (1994), Brown, L.H. (1976b), Deignan (1945, 1963), Dickinson *et al.* (1991), Eve & Gurnee (1982), Hachisaka (1934), Henry (1971), Hoogerwerf (1948), Inskipp & Inskipp (1985), King, Buck & Yong (1990), King, Woskres & Dickinson (1975), Lekagul & Round (1991), Ma Kamoon (1980), Mees (1967), Mees & Voous (1988), Medway & Wells (1976), Riley (1938), Round (1988), Smythies (1981, 1986), Thiollay & Meyburg (1988), White & Bruce (1986).



Genus *GYPOHIERAX* Rüppell, 1836

44. Palm-nut Vulture

Gypohierax angolensis

French: Palmiste africain

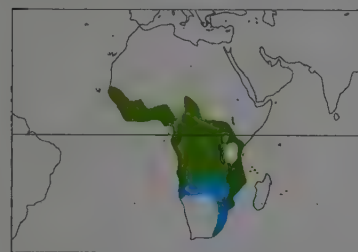
German: Palmgeier

Spanish: Buitre Palmero

Other common names: Vulturine Fish-eagle

Taxonomy. *Falco angolensis* Gmelin, 1788, Angola.

Monotypic genus, apparently intermediate between fish-eagles and vultures. Monotypic.

Distribution. Senegambia E to Kenya coast and S to Angola and NE South Africa.**Descriptive notes.** 60 cm; 1361-1712 g, mean 1470 g; wingspan 150 cm. Bare red facial skin distinctive. Relatively short, rounded wings, black back, secondaries and primary tips, and short black tail with white tip notable in flight. Juvenile brown with yellow facial skin. Most similar to *Neophron percnopterus*, which has long pointed tail that is all white in adult; also recalls juvenile *Haliaeetus vocifer*.**Habitat.** Edges of tropical forests, large rivers, lakes, estuaries and seashore, where oil palms abound. Extends to drier areas where oil or raphia palms are planted.**Food and Feeding.** Mainly fleshy pericarp of*Elaeis guineensis* and *Raphia* palm fruits. May also survive on other fruits and grain, in addition to almost any small vertebrates and invertebrates, especially fish, crabs, amphibia and molluscs; even eats some larger vertebrates (medium-sized birds or mammals), if disabled or as carrion. Spends much of each day perched at palms or hanging below fruit, pulling off fruit with the bill, then holding it in the feet to rend. Takes some fish from water surface, even at sea, but collects much other food when paddling around shoreline.**Breeding.** Laying mainly Oct/Nov-Dec in W Africa; Jun-Aug in E Africa; May-Sept in S Africa. Builds large stick platform lined with leaves and palm fronds, in open fork or crown of tall tree, palm or euphorbia. Single egg; incubation at least 44 days; chick has brown down; fledging at least 90 days; both sexes incubate, brood and feed offspring.**Movements.** Sedentary in most areas with plentiful palm fruit. Also resident in some E African coastal areas with few palms, feeding mainly on crabs, fish and carrion. A regular vagrant to drier parts of S Africa, as well as to northern savannas of W Africa, suggesting some dispersal of non-breeding adults and juveniles; also vagrant to drier sub-Saharan areas outside normal range.**Status and Conservation.** Not globally threatened. CITES II. The commonest large raptor in many lowland forest areas of W and C Africa, at densities up to 1 pair/2 km², and with c. 50% of population made up of immatures. Less common in gallery forest and drier savannas. Abundant in swamps and along coast in Sierra Leone. Readily utilizes secondary habitats, which have extended its range, but does not favour extensive oil palm monoculture. Rarely persecuted due to mainly vegetarian diet; unlikely to be vulnerable to pesticides.**Bibliography.** Benson & Benson (1975), Brooke & Jeffery (1972), Brown, C.J. (1982), Brown, L.H. *et al.* (1982), Butchart (1989), Chapin (1932), Ginn *et al.* (1989), Gore (1990), Grimes (1987), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Moreau (1933), Mundy *et al.* (1992), Pakenham (1979), Pickford *et al.* (1989), Pinto (1983), Serle (1954), Snow (1978), Tarboton & Allan (1984), Thiollay (1975a, 1975b, 1975c, 1976a, 1976b, 1977c, 1978a, 1978b, 1984), Thomson & Moreau (1957).Genus *GYPAETUS* Storr, 1784

45. Bearded Vulture

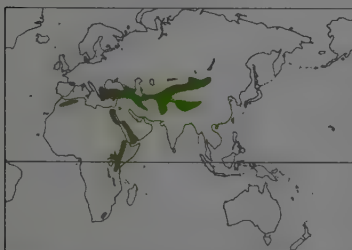
Gypaetus barbatus

French: Gypaète barbu

German: Bartgeier

Spanish: Quebrantahuesos

Other common names: Lammergeier

Taxonomy. *Vultur barbatus* Linnaeus, 1758, Santa Cruz, near Oran, Algeria.Monotypic genus, with doubtful affinities; usually considered closest to *Neophron*. Possible races *aureus* and *hemachalanus* doubtfully distinct. Two subspecies currently recognized.**Subspecies and Distribution.***G. b. barbatus* (Linnaeus, 1758) - NW Africa and SW Europe through Turkey, Egypt, Middle East, Iran and Afghanistan to Mongolia and C & NE China.*G. b. meridionalis* Keyserling & J. H. Blasius, 1840 - SW Arabia and very locally in E & S Africa.**Descriptive notes.** 100-115 cm; 4500-7100 g; wingspan 250-282 cm. Unmistakable large raptor with small "beard" of feathers, red eye-ring and long, wedge-shaped tail. Black wings and facial mask; rest of head, neck and underparts rich orange (resulting from impregnation by mineral particles; individuals very occasionally maintain original whitish coloration). Juvenile all dark, with broader wings; goes through various transitional plumages. Race *meridionalis* has lower tarsus unfeathered and lacks incipient breast band; facial pattern clearer, as lacks black markings and feathers on cheeks and crown.**Habitat.** Mountain ranges with rocky sites at which species nests and breaks bones; visits surrounding plains, and also areas of tableland. Requires large open areas with little or low vegetation, not continually covered with snow. Relies on thermals and wind for gliding flight, but to much lesser extent than most other vultures. Observed in Himalayas at over 8000 m, well above heights at which it can find food. Breeds at variable altitudes, e.g. 400-4400 m in Indian Subcontinent.**Food and Feeding.** Basically bones (up to 85% of diet), with preference for large bones. Particularly bones of medium-sized livestock (sheep, goats), on which diet is often based, or wild ungulates; eats both marrow and bone itself, and also bits of meat and skin; particularly partial to leg bones. To lesserextent feeds on carcasses of small and medium-sized animals; rodents, e.g. marmots in Europe and Asia, rock hyrax (*Procavia capensis*) in S Africa; lagomorphs; small carnivores and various birds and reptiles. On occasions, steals prey caught by other birds. Bones that it can not break are carried up into air and dropped from 20-80+ m onto particularly favoured rocky area (ossuary); bird then descends in spiral to eat. Recorded dropping tortoises in same way in SE Europe and Baluchistan. Surveys enormous areas; adult has home range of up to thousands of km² which may overlap with those of neighbouring adults. Stores food at nest, in cave or even at ossuary. Has significant relationship with man in many areas, visiting municipal carcass dumps or outskirts of farms or villages.**Breeding.** Early laying: Dec-Feb or early Mar in Europe, Asia and N Africa; May-Jul in South Africa. Monogamous, but polyandrous trios occur. Solitary, with average of 11 km between pairs on S face of Pyrenees. Nests on cliffs, mainly in caves, sometimes on ledges; large mass of sticks, c. 180 cm wide, 90 cm deep, lined with wool and other materials, e.g. animal skin and hair. Each pair normally alternates between various nests. 1-2 eggs, laid at interval of 4-5 days (3-8 in captivity); incubation 53-58 days, starting with first egg; only 1 chick hatches or survives; chick has white to pale grey down, latterly becoming browner; adults share incubation and feeding of chick; fledging 106-130 days; juvenile can receive food from parents for 7-12 months more. Average 0.6-0.9 birds fledge per clutch in Pyrenees. Sexual maturity at c. 7 years, although inexperienced pairs may not breed until 10-12 years (in captivity, has bred at 4 years old). Juvenile mortality apparently low. In captivity can live to more than 40 years old.**Movements.** Sedentary, although with enormous home range. Normally, neither adults nor juveniles seen in mountains outside normal range. Juveniles dispersive, particularly in summer, but less so than other vultures, usually not leaving natal mountain range: will visit regular feeding sites, sometimes near human settlements, and may settle temporarily near such sites; birds become sedentary with age.**Status and Conservation.** Not globally threatened. CITES II. Currently considered near-threatened. Massive decline in 19th and 20th centuries, particularly in Europe, but also in N and S Africa and W Asia; only small isolated populations survived. Little known populations of E Africa apparently still numerous, with rough estimate of 1400-2200 pairs in early 1990's; also seems numerous in C Asia and Himalayas, but rarer e.g. in Baluchistan (Pakistan). Stable and slightly increasing in Pyrenees, with 75 established pairs (including 14 trios) in 1993, of which to date only 60 breed; vestigial populations in Corsica (8 pairs in early 1990's) and Crete (perhaps 12-15 pairs in early 1980's, but with subsequent decline). Critical situation in SE Europe: perhaps 20 pairs in continental Greece in early 1980's, but in decline; virtually extinct in Macedonia by early 1990's. Current estimates of 30-40 pairs in Azerbaijan and perhaps 30 pairs in European Russia; 2 pairs in Israel in early 1980's. Also in 1980's, 204 pairs in Lesotho and E South Africa, and maximum 100 pairs in N Africa; probably extinct in Algeria and Tunisia. Project of reintroduction in Alps: 50 captive-bred young released in period 1986-1993; high survival rate, and some pairs established by early 1990's. Another conservation initiative that is becoming widespread is creation of feeding stations, which assist in survival of young. Main causes of decline were and still are poisoned baits set for carnivores, and direct persecution; robbing of nests particularly widespread in 19th century. By late 20th century degradation of habitat, disturbance in breeding areas and reduction of extensive livestock farming becoming increasingly important.**Bibliography.** Ali & Ripley (1978), Anderegg (1982), Attwell (1963), Bates (1939), Belik (1984, 1985, 1990), Bergier (1987), Blumstein (1990), Boshoff *et al.* (1978), Boswall (1970), Boudoint (1976), Bouvet (1985), Brooke (1984), Brown, C.J. (1985a, 1988c, 1989a, 1990a, 1990b, 1990c, 1990d, 1991a), Brown, C.J. & Bruen (1991), Brown, C.J. & Plug (1990), Brown, C.J. *et al.* (1988), Brown, L.H. (1977), Brown, L.H. *et al.* (1982), Canut *et al.* (1987a), Clancey (1985), Clouet (1984), Cramp & Simmons (1980), Delibes *et al.* (1984), Dementiev & Gladkov (1951), Dendeleche (1988), Dondzar (1993), Elósegui (1989), Eichécopar & Hue (1978), Fasce *et al.* (1989), Finch-Davies & Kemp (1980), Fleming (1955), Flint *et al.* (1984), Frey (1992), Frey & Bijleveld (1994), Ginn *et al.* (1989), Glutz von Blotzheim *et al.* (1971), Gmelin (1788), Goodman *et al.* (1989), Guy (1976), Hablitzl (1983), Handrinos (1985), Handrinos & Demetropoulos (1983), Heredia & Donazar (1990), Heredia & Heredia (1991), Hiraldo *et al.* (1979, 1984), Houston *et al.* (1993), Huxley & Nicholson (1963), Keyserling & Blasius (1840), Kumerloeve & Gélouet (1964), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Müller (1988), Mundy *et al.* (1992), Newman (1969), North (1944, 1948), Parellada (1984a), Paz (1987), Patrinkev (1993), Penzhorn (1969), Pollard (1947), Roberts (1991), Rogacheva (1992), Simeonov *et al.* (1990), Smith (1965), Steyn (1961), Steyn (1982), Suetens & van Groenendael (1972), Sunyer & Heredia (1989), Terrasse, J.F. (1985), Terrasse *et al.* (1961), Thaler & Pechlaner (1980), Thaler *et al.* (1986), Thibault *et al.* (1993), Thiollay (1968a), Vasic *et al.* (1985), Wilbur & Jackson (1983).Genus *NEOPHRON* Savigny, 1809

46. Egyptian Vulture

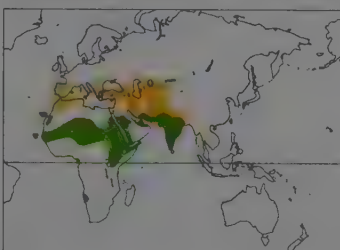
Neophron percnopterus

French: Vautour percnoptère

German: Schmutzgeier

Spanish: Alimoche Común

Other common names: (White) Scavenger Vulture

Taxonomy. *Vultur Perenopterus* [sic] Linnaeus, 1758, Egypt.Monotypic genus, possibly closest to *Gypaetus*, although has been combined with *Necrosyrtes*. Two subspecies recognized.**Subspecies and Distribution.***N. p. percnopterus* (Linnaeus, 1758) - S Europe E to C Asia (E Kazakhstan) and NW India, and S through N Africa, Arabia and Sahel zone to N Tanzania; SW Angola and NW Namibia; also Canary Is, Cape Verde Is and Socotra.*N. p. ginginianus* (Latham, 1790) - Nepal and India (except NW).**Descriptive notes.** 58-70 cm; 1600-2200 g; wingspan 155-170 cm. Small vulture with unique plumage, resembling that of European White Stork (*Ciconia ciconia*); marked contrast, especially in underparts, between overall white coloration and black flight-feathers; bare yellow face; short, wedge-shaped tail; legs greyish white, pink or pale yellow. Juvenile dark, particularly on underparts; intermediate plumages progressively lighter. Race *ginginianus* slightly smaller, with whole bill yellow.**Habitat.** Extensive open areas mainly in dry or arid regions, although sometimes around fringe areas of wet or cold climates; steppe,

desert, scrub, pastures and fields of cereals; requires rocky sites for nesting. Occurs in flat or mountainous regions, normally at low or medium altitudes, but occasionally higher up in mountainous

regions, e.g. seen at 4500 m in Ethiopia; nests from cliffs at sea-level up to sites at 2600 m in India. At present, range greatly affected by species' dependence for food on livestock and human waste; lives as scavenger near or even in towns, e.g. urban dweller in India and at beginning of century in Cairo. Normally solitary or in pairs; dozens of individuals, very occasionally 100+, may congregate at feeding points or at roosts on cliffs, buildings or trees.

Food and Feeding. Opportunist; able to take very varied types of food. Mainly carrion, including all sorts of dead vertebrates, from passerine birds and small mammals to livestock and large wild animals; normally eats only scraps of large carcasses, rejected by other vultures. To lesser degree, preys on small animals, often weak or injured ones, e.g. rabbits, chicks, spawning or dying fish, and terrapins; also insects, e.g. dung beetles (Coleoptera). Occasionally birds' eggs, notably *Ostrich* (*Struthio camelus*) eggs; breaks these by throwing stones at them, one of rare cases of tool use in avian world. Wide range of organic waste important, including excrement and rotting fruit and vegetables. Spots food from low surveying flight, higher soaring flight or from perch. Non-breeding birds travel up to 80 km daily from roost in search of food. Species heavily dependent on rubbish dumps and also traditional sites where carcasses of domestic animals dumped; commensal with man over extensive regions.

Breeding. Generally breeds later in year than other Palearctic vultures, although in S Sahara may breed from Jan or even earlier; Mar-Apr in Punjab, Canary Is and N Africa; Apr-May throughout Mediterranean range. Normally monogamous; rarely forms polyandrous trios. Solitary; in Europe normally at least 1.5 km between pairs; exceptionally 2 nests together, in Cape Verde Is; in Delhi, 0.5 pairs/km². Nests in cliffs, occupying caves or ledges protected by overhang; very occasionally nests in trees. Stick nest up to 1.5 m wide or more; usually lined abundantly with wool, hair, rags and remains of food, but sometimes with scarcely any material. Pairs often have several nests, alternating between them from year to year. Normally 2 eggs, occasionally only 1; incubation c. 42 days; both adults incubate eggs and feed chicks; chicks have white down; fledging c. 70-85 days; possibly only 1 month of dependency on adults. Great local variation in success: average 1.2-1.4 chicks (up to 1.75) fledge per successful pair; but some pairs (often 20-30% of potential breeders) do not lay. Sexual maturity at 4-5 years; known to live up to 37 years old in captivity.

Movements. Migratory in N of range; sedentary in Arabia, sub-Saharan Africa, Balearic Is and Canary Is; mainly sedentary in Indian Subcontinent, but locally migratory in some regions. Present in N breeding areas mainly Mar-Sept; winter sightings very rare, although species winters in small numbers in Coto de Doñana (SW Spain). Most migrants cross to Africa at Gibraltar; Suez and Bab al Mandab also important; nowadays, species winters only N of equator; some juveniles remain in Africa throughout second year.

Status and Conservation. Not globally threatened. CITES II. Has undergone fairly general decline, at least in Europe; population now more stable, and even recovering in some areas. Total population of Africa may number 7500 pairs and up to 20,000 birds, with largest concentration in Ethiopia; isolated nucleus of maybe only 10 pairs in Angola and Namibia; relict population may hang on in South Africa (2 birds seen in Transvaal in 1989). Main European population in Spain, with at least 1324-1373 pairs in late 1980's, including c. 35 pairs in Canary Is; in 1980's, perhaps over 100 pairs in Portugal, c. 50 pairs in former Yugoslavia, and 200-250 pairs in Greece; in early 1990's, 67 pairs in France, maximum 13-14 pairs in Italy, c. 100 pairs in Bulgaria, a few pairs in Crimea, and possibly 50 pairs in European Russia. Asian populations certainly sizeable, especially those of India and Pakistan, but generally little known, with no figures available; at least 80-100 pairs in Azerbaijan; 90 pairs in Israel in 1982, with increase following serious decline caused by rodenticide poisoning; sizeable population on Socotra. Factors responsible for some declines include strychnine and pesticide poisoning, and direct persecution; reduction in availability of food, due to decrease in amount of large-scale livestock farming, and also in traditional use of local municipal carcass dumps; decline in populations of small prey species; and increasing vulnerability of breeding areas.

Bibliography. Ali & Ripley (1978), Baumgart (1991a), Bergier (1987), Bergier & Cheylan (1980), Bernis (1975, 1980), Bologna (1977), Boswall (1977), Brailton (1979), Brooke (1979), Brosset (1961), Brown *et al.* (1982), Bundy (1976), Carlson (1992), Ceballos & Donazar (1989a, 1989b, 1990a, 1990b), Chapman & Buck (1893, 1910), Cheylan (1978, 1979), Christensen *et al.* (1981), Cloudsley-Thompson (1981), Cortone & Liberatori (1989), Cramp & Simmons (1980), Davidovitz & Leshem (1981), Dendaleite (1988), Donazar (1993), Donazar & Ceballos (1989, 1990), Dupuy (1969), Elősegi (1989), Etchéopar & Hie (1964), Finlayson (1992), Frumkin (1986), Galushin (1971), Genshel (1986), Giraudeau *et al.* (1988), Glutz von Blotzheim *et al.* (1971), Goodman *et al.* (1989), Grubac (1989, 1991), Handrinos (1985), Handrinos & Demetropoulos (1983), Houston (1983), Jackson (1938), Janossy (1989), Jaubert (1989), van Lawick-Goodall (1968), Levy (1989, 1990, 1991), Levy & Mendelsohn (1989), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Mundy (1978), Mundy *et al.* (1992), North (1944, 1947), Patrikeev (1993), Paz (1987), Pennycook (1972), Perea *et al.* (1990), Perennou *et al.* (1987), Pickford *et al.* (1989), Pinto (1983), Polo *et al.* (1992), Richardson (1990), Roberts (1991), Rookmaker (1989), Serfontein (1961), Shirihai & Christie (1992), Simeonov *et al.* (1990), Stresmann (1944), Tella (1993), Terrasse (1983), Terrasse & Thauront (1988), Terrasse *et al.* (1961), Thaler *et al.* (1986), Thiollay (1967a, 1978c, 1985d, 1989), Thomsen & Jacobsen (1979), Thouless *et al.* (1989), Valverde (1957), Welch & Welch (1988), Wilbur (1983), Wilbur & Jackson (1983).

Genus *NECROSYRTES* Gloger, 1841

47. Hooded Vulture

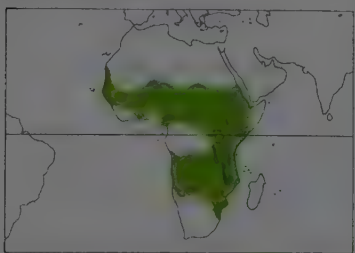
Necrosyrtes monachus

French: Vautour charognard **German:** Kappengeier **Spanish:** Alimoche Sombrio

Taxonomy. *Cathartes monachus* Temminck, 1823, Senegal.

Monotypic genus sometimes combined with *Neophron*, but differs markedly in morphology and e.g. nesting behaviour. Two subspecies sometimes recognized, with nominate race in W Africa, and rest of range covered by race *pileatus*; but variation only in size, and clinal from small in W to large in S. Monotypic.

Distribution. Mauritania E to Ethiopia and S to Namibia and South Africa, except areas of uninterplanted forest or desert.



Descriptive notes. 67-70 cm; 1530-2600 g, mean 2028 g; wingspan 170-182 cm. Small vulture with long thin bill and pink face that can flush bright purple. Sexes alike. Juvenile usually with face pale blue and hood of short down dark brown rather than beige; similar to juvenile *Neophron percnopterus*, but head has covering of down, as opposed to contour feathers and tail not pointed. Overall most resembles *Torgos tracheliotus*, but much smaller and finer-billed.

Habitat. Mainly open woodland and savanna; absent from desert and dense forest, except where enters secondary forest, clearings, settlements and urban areas, in W and NE Africa, as commensal with man.

Food and Feeding. Carrion and some small insects; also food scraps and excreta around human habitation. Locates small items from low flights, that are early relative to those of larger vultures. Gregarious at larger carcasses but unable to compete with larger species, usually taking scraps and fighting with conspecifics around edges of the fray. Uses fine bill to pick meat from between bones after larger species have left, and to extract insects from soil and dung.

Breeding. Laying usually after rainy season: Oct-Mar in W and NE Africa; Jan and Apr-Jul in E Africa; May-Aug in S Africa. Builds small stick nest in upper fork of large tree, usually deep within foliage and not on the crown as in other vulture species; rarely on building or cliff. Single egg; incubation 48-54 days; chick has brown first down, darker second down; fledging 89-130 days; parents alternate roles in raising offspring, for up to c. 4 months after first flight.

Movements. No regular movements reported except for Jun-Sept wet season extension into S Sahara. Probably sedentary in most areas, but may range over 200 km when not breeding, especially juveniles. Vagrant to Morocco.

Status and Conservation. Not globally threatened. CITES II. Common to locally abundant in many areas of W and NE Africa, where well integrated with human development and agriculture; has expanded range considerably in Sierra Leone, with destruction of forest. Much less common in wilderness areas further S where not commensal with man, e.g. 50 pairs in Transvaal lowveld, South Africa. Recently subjected to some persecution and poisoning in W and S Africa.

Bibliography. Bannerman (1953), Benson & Benson (1975), Brown *et al.* (1982), Cramp & Simmons (1980), Ginn *et al.* (1989), Gore (1990), Grimes (1987), Houston (1989), Hustler & Howells (1988a), Kruuk (1967), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Mundy & Cook (1972, 1975), Mundy *et al.* (1992), Pickford *et al.* (1989), Pinto (1983), Serle (1943), Snow (1978), van Someren (1956), Tarboton & Allan (1984), Thiollay (1978c, 1985d), Wilson, R.T. (1982).

Genus *GYPs* Savigny, 1809

48. African White-backed Vulture

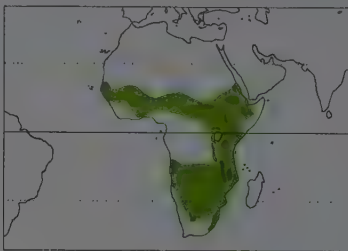
Gyps africanus

French: Vautour africain **German:** Weißrückengeier **Spanish:** Buitre Dorsiblanco Africano
Other common names: White-backed (Griffon) Vulture

Taxonomy. *Gyps africanus* Salvadori, 1865, Sennar, Sudan.

Forms superspecies with *G. bengalensis*, with which has been considered conspecific; these two sometimes partitioned off in genus *Pseudogyps*, on grounds of usually having 12 not 14 rectrices. Possibility of three geographically discrete populations that differ on size, but not named. Monotypic.

Distribution. Mauritania E to Ethiopia and S to N and E South Africa.



Descriptive notes. 94 cm; 4150-7200 g, mean 5450 g; wingspan 218 cm. White lower back and underwing-coverts conspicuous against dark brown plumage and black skin on neck and head of adult. Becomes paler and plainer with age, especially female. Dark eye and neck separate from adult of larger, paler *G. coprotheres*. Juvenile always darker, each contour feather streaked with lighter brown, and ruff feathers long and lanceolate.

Habitat. Various open woodlands, savannas and steppes; only absent from extreme desert and dense forest.

Food and Feeding. Carrion and bone fragments of larger carcasses, mainly soft muscle and organ tissue. Usually gregarious, feeding and fighting amidst a hectic scrumage to obtain flesh, even thrusting the long bare neck under the skin or crawling into the rib-cage. May also come down to small dead animals and afterbirth. Soars together with other vultures, using their behaviour and that of carnivores, including man, to locate food. After feeding, usually bathes together with other species at favourite sites.

Breeding. Laying usually at start of dry season: Oct-Jan in W and NE Africa; all months in E Africa; Apr-Jun in C and S Africa. Builds platform of sticks, lined with grass and green leaves, on crown of large tree or less often in an open fork, frequently along a watercourse; rarely nests on a pylon. Frequently clumped in loose colonies of 2-13 nests, some of which only persist for a few years. Single egg (rarely 2-3); incubation 56 days; chicks have pale grey down; parents take turns to incubate, brood and feed offspring; fledging 120-130 days.

Movements. Sedentary in many areas, but in W Africa moves N in the Jul-Sept wet season to less densely vegetated areas, and S again in dry season. Possibly migrates down Rift Valley of Uganda in Jul. Marked birds indicate some long-distance movements, mainly dispersive, but also to exploit new food sources.

Status and Conservation. Not globally threatened. CITES II. The commonest African griffon-like vulture of savanna and woodland by 4-5 times, e.g. in many large reserves and ranches, with 2500 breeding pairs estimated for Transvaal alone. Subject to some persecution, poisoning and range reduction in parts of S, C and NE Africa, but has also expanded to adopt power pylons as nest-sites in S Africa.

Bibliography. Allan (1988b), Bannerman (1953), Benson & Benson (1975), Brown *et al.* (1982), Dowsett & Dowsett-Lemaire (1980), Ginn *et al.* (1989), Gore (1990), Grimes (1987), Houston, D.C. (1974a, 1974b, 1975, 1976, 1989, 1993), Howells & Hustler (1984), Kemp & Kemp (1975a), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Mundy (1982), Mundy *et al.* (1992), North (1944), Pickford *et al.* (1989), Pinto (1983), Tarboton & Allan (1984), Thiollay (1978b, 1978c).

49. Indian White-backed Vulture

Gyps bengalensis

French: Vautour chaugoun **German:** Bengelengeier **Spanish:** Buitre Dorsiblanco Bengali
Other common names: (Oriental) White-backed/White-rumped Vulture

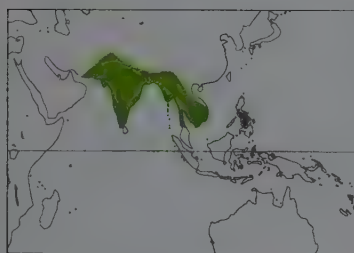
Taxonomy. *Vultur bengalensis* Gmelin, 1788, Bengal.

Forms superspecies with *G. africanus*, with which sometimes considered conspecific; these two sometimes separated off in genus *Pseudogyps*. Monotypic.

Distribution. SE Iran, Afghanistan (perhaps irregularly) and Pakistan through Nepal and India to SC China (Yunnan), Indochina and N Malay Peninsula.

Descriptive notes. 76-93 cm; 3500-6000 g; wingspan 205-220 cm. Blackish, medium-sized vulture with white lower back; underwing-coverts conspicuously all white; bill and cere dark. Juvenile dark brown, with streaked underparts.

Habitat. Inhabits open country near villages, towns and cities, as well as parks and sanctuaries, in lowlands and Himalayan foothills up to 4500 m. Often closely associated with man, large numbers congregating in and around towns, especially by rubbish dumps and slaughterhouses. Often gathers



to roost in large numbers for long periods in trees; repeated use of same trees can lead to trees being killed by accumulation of droppings, sometimes causing problems thus in groves of coconut palms, mangos, etc.

Food and Feeding. Exclusively carrion, especially remains of cattle. Regularly feeds in company of other vultures, especially *G. indicus*, and also other scavengers, e.g. jackals, corvids and dogs. Carrion located by means of keen eyesight; soaring vultures also watch other flying vultures and other scavengers; when one drops to carcass, all birds in sight follow suit, and many can gather in short time.

As in other vulture species, birds tend to gorge themselves, then rest for long period nearby, on ground or tree, while food is digested.

Breeding. Season Oct-Mar. Sometimes forms small colony in grove of trees. Large stick nest built by pair 5-30 m up large tree, often in village, town or even city, and usually next to road, stream or canal. Display flights consist of close mutual soaring of pair. 1 egg (reports of 2 eggs probably involve two females laying in same nest); incubation at least 45 days, by both sexes; fledging c. 3 months; period of post-fledging dependency unknown. High density of 2-7 pairs/km² in Delhi, N India.

Movements. Mainly sedentary. Vagrant in past to Borneo, presumably from Malay Peninsula, in period when more numerous there.

Status and Conservation. Not globally threatened. CITES II. Common to abundant throughout most of range; less common in S India and W Pakistan; rare in W Yunnan (S China); in most of Thailand and Malay Peninsula relatively common in past, but now rare or absent. Well adapted to living in close proximity to humans, feeding extensively at rubbish dumps, where frequently ignores human presence; can cause conflict.

Bibliography. Ali & Ripley (1978), Cheng Tso-hin (1987), Deignan (1945, 1963), Etchécopar & Hùe (1978), Galushin (1971), Grubb (1980), Gyldestolpe (1920), Hollom *et al.* (1988), Holmes & Wells (1975), Hùe & Etchécopar (1970), Humphrey & Bain (1990), Inskipp & Inskipp (1985), King *et al.* (1975), Lekagul & Round (1991), MacKinnon & Philipps (1993), Medway & Wells (1976), Meyer de Schauensee (1984), Proud (1949), Roberts (1991), Riley (1938), Round (1988), Sathesan (1989, 1989e), Smythies (1981, 1986).

50. Long-billed Vulture

Gyps indicus

French: Vautour indien

German: Dünnschnabelgeier

Spanish: Buitre Picofino

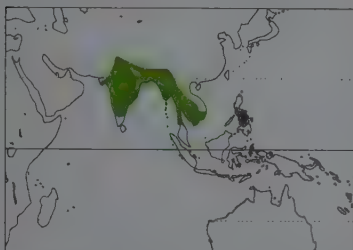
Taxonomy. *Vultur indicus* Scopoli, 1786, India.

May form superspecies with *G. himalayensis*, *G. fulvus*, *G. coprotheres* and *G. rueppellii*. Race *tenuirostris* sometimes considered separate species because of differences in plumage and nest substrate, but further research required to justify this split. Birds of Punjab hills erroneously ascribed separate race, *jonesi*; this population actually belongs to *G. fulvus*. Two subspecies recognized.

Subspecies and Distribution.

G. t. tenuirostris G. R. Gray, 1844 - lower Himalayas, from Kashmir through Nepal to Assam, and SE into Indochina and N Malay Peninsula.

G. i. indicus (Scopoli, 1786) - SE Pakistan and India S of R Ganges, except extreme S.



Descriptive notes. 80-100 cm; 5500-6300 g; wingspan 205-229 cm. Medium-sized vulture with pale body and wing-coverts; blackish neck, with whitish down; bill mostly pale yellow. Paler than *G. bengalensis*, somewhat sligher than most other congeners, with bill more slender. Juvenile darker. Race *tenuirostris* larger; head and neck darker, lacking whitish down; also darker above, especially on wings; only culmen of bill is pale.

Habitat. Inhabits open country near villages, towns and cities, as well as parks and sanctuaries; usually in company of *G. bengalensis*, but in lower numbers. Race *indicus* occurs on

plains, nesting on cliffs; race *tenuirostris* occurs in Himalayan foothills and nests on trees.

Food and Feeding. Feeds exclusively on carrion, mostly cattle. Feeds in company of other vultures, especially more numerous *G. bengalensis*, with which often joins in carrion feeding guild. Carrion located by means of keen eyesight; soaring vultures also watch other flying vultures and other scavengers; when one drops to carcass, all birds in sight follow suit, and many can gather in short time. Feeding sessions can be raucous at times, with many grunts and hisses, as vultures fight over place to feed.

Breeding. Season Nov-Mar. Often colonial. Races differ in nesting substrate. Widespread race *indicus* breeds in small to large colonies on cliffs; nest is loose platform of sticks lined with straw; usually destroyed by nestling which pushes sticks off ledge. Himalayan race *tenuirostris* nests in trees; builds compact nest 7-15 m up large leafy tree; often nests in small group or colony, usually near village. Display flight not described, but probably, as in other *Gyps*, includes mutual soaring. 1 egg; adults share nesting duties; chick has yellowish brown down. No further information available.

Movements.

Status and Conservation. Not globally threatened. CITES II. Fairly common throughout most of range, although usually less numerous than sympatric *G. bengalensis*. Rare and local throughout SE Asia, but reasons for decline unknown; may now be extinct in Thailand.

Bibliography. Ali & Ripley (1978), Deignan (1963), Grubb (1980), Humphrey & Bain (1990), Inskipp & Inskipp (1985), King *et al.* (1975), Lekagul & Round (1991), Medway & Wells (1976), Ripley (1982), Roberts (1991), Round (1988), Smythies (1986).

51. Rüppell's Griffon

Gyps rueppellii

French: Vautour de Rüppell

German: Sperbergeier

Spanish: Buitre Moteado

Other common names: Rüppell's Vulture

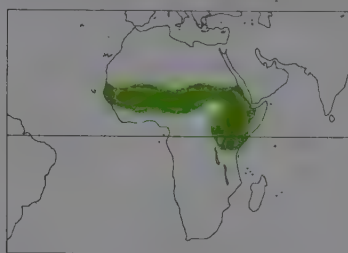
Taxonomy. *Vultur Rueppellii* A. E. Brehm, 1852, Khartoum, Sudan.

Forms superspecies with *G. fulvus* and *G. coprotheres*, and possibly also with *G. himalayensis* and *G. indicus*. Two subspecies recognized.

Subspecies and Distribution.

G. r. rueppellii (A. E. Brehm, 1852) - SW Mauritania E to Sudan, N to Aïr Massif (NW Niger) and S to Uganda, Kenya and N Tanzania.

G. r. erlangeri Salvadori, 1908 - Ethiopia, Eritrea and NW Somalia, possibly ranging to S Arabia.



Descriptive notes. 101 cm; 6800-9000 g, mean 7570 g; wingspan 241 cm. Pale tips to contour feathers give scaled appearance (individually variable); yellow eye and orangish bill also distinctive. Juvenile with black bill and eye; paler with broadly streaked plumage. Races separated on size and colour, but may intergrade.

Habitat. Open sub-Saharan habitats of arid steppe and grassland up to 4500 m; occurs in or around mountains for orographic lift, and cliffs and gorges for roosting and breeding.

Food and Feeding. Carrion and bone fragments of larger carcasses, mainly soft muscle and organ tissue. Roosts, soars and feeds com-

munity, fighting with other vulture species to obtain flesh and often inserting the strong bare neck under the skin or crawling into the rib-cage. Follows other vultures and migrant game or stock herds to locate much of its food. Rarely comes down to small carrion.

Breeding. Laying usually after long rainy season: Oct-Dec in W and NE Africa; Jun-Aug in Kenya; enigmatically, Dec-Jan in one decade, then Jul-Sept in another in Tanzania. Breeds on cliff faces in colonies of 10-1000 pairs; builds platform of sticks, lined with grass and placed on an open ledge; in N Cameroon, also nests in trees, alone or in small nuclei. Single egg; incubation c. 55 days; chick has grey down; parents share care of egg and chick; fledging c. 150 days.

Movements. No regular movements in most areas, although may wander daily 150-200 km from nesting and roosting cliffs. In W Africa moves S in dry season to edge of Guinea woodlands. In E Africa juveniles may move to areas outside range of breeding colonies. Vagrant to Egypt.

Status and Conservation. Not globally threatened. CITES II. Total population estimated at 30,000 birds, including 3000 pairs in Tanzania, and 2000 pairs each in Kenya, Ethiopia, Sudan and W Africa. Less studied than other griffons; several colonies in Kenya reported to have declined through agricultural encroachment and poisoning. Widely killed for use in traditional medicines.

Bibliography. Bannerman (1953), Brown & Britton (1980), Brown *et al.* (1982), Cramp & Simmons (1980), Etchécopar & Hùe (1964), Gallagher & Woodcock (1980), Gore (1990), Hollom *et al.* (1988), Houston, D.C. (1974a, 1974b, 1975, 1976, 1989, 1990, 1993), Jensen & Kirkeby (1980), Kruuk (1967), Lippens & Wille (1976), Mackworth-Præd & Grant (1975-1973), Morel & Morel (1990), Mundy *et al.* (1992), Nikolaus (1987), Pennycook (1983), Thiollay (1978c).

52. Himalayan Griffon

Gyps himalayensis

French: Vautour de l'Himalaya

German: Schneegeier

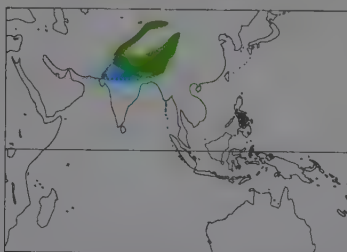
Spanish: Buitre del Himalaya

Other common names: Himalayan Griffon Vulture

Taxonomy. *Gyps himalayensis* Hume, 1869, Himalayas.

Sometimes considered a race of *G. fulvus*, but ranges overlap and plumages distinct. May form superspecies with *G. indicus*, *G. fulvus*, *G. coprotheres* and *G. rueppellii*. Monotypic.

Distribution. Himalayas from N Pakistan and N India through S Tibet and Nepal to Bhutan, N Assam and C China; also NE through Pamirs to Tien Shan, and possibly also into Tarbagatai and Altai.



Descriptive notes. 116-150 cm; 8000-12,000 g; wingspan 260-310 cm. Large, pale vulture; largest *Gyps*; great individual variation in size, with some birds huge. Purplish pink patch of bare skin at base of neck. Body and wing-coverts whitish, lacking tawny tones of *G. fulvus*. Generally tends to be paler than *G. indicus*; palish bill, largely yellowish. Juvenile dark, with narrow pale streaks on underparts and upperwing-coverts; immature plumages progressively paler overall.

Habitat. Mountains, mostly 1500-4000 m, but down to 900 m in Himalayas, and even recorded up to 5000 m in Nepal. In winter, generally somewhat lower, a few juveniles wandering down onto plains.

Food and Feeding. Feeds exclusively on carrion. Soars and glides over vast areas, searching for carcasses and watching other vultures. Gathers in small numbers at carcasses; these can be devoured very rapidly. At carcasses, dominant over other vultures, except *Aegypius monachus*. Feeding at times can be raucous, with many grunts and hisses, as vultures fight over a place to feed. Reported to follow caravans and domestic flocks in high mountains.

Breeding. Nest building or repair usually begins in late winter; laying generally in Jan, but Feb-Mar in Russia. Nests may be solitary or in small groups with up to 6 pairs. Large, loose nest on cliff face built or simply repaired by pair. Display flights consist of close mutual soaring of pair. Almost invariably 1 egg; incubation c. 50 days; fledging and dependency periods unknown, but entire nest cycle extends for 7 months or more.

Movements. Sedentary, with limited altitudinal movements; a few juveniles straggle S onto plains of N India in winter. Vagrant to Afghanistan and Turkmenistan.

Status and Conservation. Not globally threatened. CITES II. Apparently common in W China and throughout Himalayas of Pakistan, India, Tibet and Nepal, e.g. common in Great Himalayan National Park, Himachal Pradesh (N India); uncommon in mountains of C China.

Bibliography. Ali & Ripley (1978), Cheng Tso-hin (1987), Dementiev & Gladkov (1951), Etchécopar & Hùe (1978), Flint *et al.* (1984), Inskipp & Inskipp (1985), Krystautas (1993), Meyer de Schauensee (1984), Ripley (1982), Roberts (1991).

53. Eurasian Griffon

Gyps fulvus

French: Vautour fauve

German: Gänsegeier

Spanish: Buitre Leonado

Other common names: Griffon Vulture

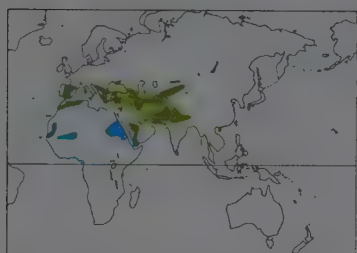
Taxonomy. *Vultur fulvus* Hablizl, 1783, Samamisia Alps, Gilan, Iran.

Sometimes considered conspecific with *G. coprotheres*; also occasionally with *G. himalayensis*. Forms superspecies with *G. coprotheres* and probably with *G. rueppellii*; possibly also with *G. himalayensis* and *G. indicus*. Population of Punjab Salt Range (Pakistan), erroneously described as *G. indicus jonesi*, actually belongs to race *fulvescens* of present species. Two subspecies recognized.

Subspecies and Distribution.

Gyps f. fulvus (Hablizl, 1783) - NW Africa and Iberian Peninsula E through Balkans, Turkey, Middle East, Arabia and Iran to Pamirs and Altai.

Gyps f. fulvescens Hume, 1869 - Afghanistan, Pakistan and N India E to Assam.



Descriptive notes. 95-110 cm; 6000-11,000 g; wingspan 240-280 cm. Whitish head, neck and collar; dark centres to greater upperwing-coverts. Similar to the other griffon vultures: smaller and somewhat browner than *G. himalayensis*; larger and normally paler than *G. bengalensis*, *G. indicus* and *G. africanus*. Juvenile has brown collar and darker back than adult.

Habitat. Expansive open areas; wide range of habitats, including mountains, plateaux, steppe and even semi-desert, with abrupt rocky areas such as crags and canyons for nesting and roosting. Soaring flight requires updraughts associated with slopes and cliffs, or thermals;

generally prefers dry, sunny areas; also dependent on presence of livestock. Breeds at wide range of altitudes, from cliffs at sea-level, e.g. Sardinia and Croatia, up to 2750 m in Caucasus; recorded considerably higher.

Food and Feeding. Exclusively, or almost exclusively, carrion; feeds mainly on muscles and viscera of medium-sized and large mammals, especially ungulates. Original wild prey species (mountain goats, deer, gazelles) now replaced to greater or lesser extent by domestic species (sheep, goats, cows, horses), on which present species has often become totally dependent; sometimes eats other mammals (carnivores, rabbits and hares, cetaceans, etc). Birds co-operate in search for food, dispersing up to 10's of km from colony or roost, exploring wide areas meticulously; when individual locates carrion, other birds within sight will congregate. Regularly visits traditional municipal carcass dumps, where these still exist.

Breeding. Laying Dec-Mar or later; replacement clutches till May; laying can be spread over 3 months at any given colony. Colonial; normally under 20 pairs, though most breeding pairs may concentrate in largest colonies of up to 150 pairs. Nests on crag or cliff, preferring protected ledge or small cave; thin, fairly small platform of branches, sometimes stolen from other large raptors, e.g. eagles, *Gypaetus barbatus*, occasionally tree-nesting *Aegypius monachus*. 1 egg; incubation 50-58 days; both adults incubate egg, and feed chick by regurgitating semi-digested food; first down short and white, second down longer and creamy white to pale grey; fledging 110-130 days; chicks may receive food from parents for 3 months more. Breeding success in Spain 0.76 chicks fledged per clutch (similar in French Pyrenees). First breeding can occur at 4 years old, but normally older. Known to live up to 37 years old in captivity.

Movements. Sedentary and partly migratory; juveniles disperse widely, accounting for most sightings outside normal range, e.g. vagrants in C & N Europe. A few thousand birds, mainly juveniles, winter in Africa, with crossings at Straits of Gibraltar (peak Oct-Nov), Bosphorus and Suez; occur S to Senegal, Mali and Niger; in smaller numbers, E to Sudan and Ethiopia; mainly visit zones of savanna and steppe. Not all of these birds return to Europe in spring; peak crossing into Iberian Peninsula in Apr-May. Shorter seasonal or nomadic movements also occur, in relation to climate and movements of livestock herds.

Status and Conservation. Not globally threatened. CITES II. Favoured in past by increases in livestock farming and also in extent of pastures. Widespread decline in most of 20th century in Europe, N Africa and Middle East, mainly due to poisoned baits set for carnivores, direct persecution, and in some areas reduction in available food supplies. Very little information available on population trends in Asia, but probably more stable in E parts of range. Spectacular recent recoveries in places; notably in Spain, main population of W, with at least 8100 pairs and 23,000-24,500 individuals in 1989; significant increase in French Pyrenees, with c. 300 pairs in early 1990's; successful reintroduction in Massif Central (SE France), with first birds released in 1981, but over 30 pairs breeding by early 1990's (see page 103). In 1980's, c. 1100 pairs in rest of Europe: c. 300 pairs in European Russia (1990's); 100-150 pairs in Portugal; 30 pairs on Sardinia; c. 450 pairs in mainland Greece and Crete; c. 200 pairs in former Yugoslavia; up to 10 pairs in Bulgaria. In same period: perhaps 100-150 pairs in NW Africa, where considered very rare; c. 500-1000 pairs in Turkey; c. 70 pairs in Israel; c. 100-120 pairs in Azerbaijan. Species readily capable of recovery, if efficiently protected, with reliable food sources accessible.

Bibliography. Ali & Ripley (1978), Arroyo *et al.* (1990a), Ben-Zohar (1986), Bergier (1987), Bijlsma (1983), Bonnet *et al.* (1990), Brown *et al.* (1982), Bundy (1976), Christensen *et al.* (1981), Cramp & Simmons (1980), Dendaletche (1988), Donazar (1993), Donazar *et al.* (1987), Elósegui (1987, 1989), Etchecopar & Húe (1978), Finlayson (1992), Flint *et al.* (1984), Frumkin (1986), Genaro (1985), Génsbol (1986), Glutz von Blotzheim *et al.* (1971), Goodman *et al.* (1989), Habbizl (1983), Handrinos (1985), Handrinos & Demetropoulos (1983), Jaubert (1989), Jennings (1987), Leconte (1977, 1985), Mackworth-Præd & Grant (1957-1973), Marinovic & Örländic (1994), Marinovic *et al.* (1985), Mundy (1985b), Mundy *et al.* (1992), Natorp (1986), Nikolaus (1987), Nogué (1982), Paz (1987), Perco *et al.* (1983), Polo *et al.* (1992), Popov & Verzhutskii (1990), Roberts (1991), Rufino *et al.* (1985), Simeonov *et al.* (1990), Soto (1986), Terrasse (1977), Terrasse & Thauront (1988), Terrasse, Bagnolini *et al.* (1994), Terrasse, Terrasse & Budoint (1961), Thaler *et al.* (1986), Valverde & Bemis (1960), Welch & Welch (1988), Wilbur & Jackson (1983), Whympner (1909).

54. Cape Griffon

Gyps coprotheres

French: Vautour chasseur

German: Kapgeier

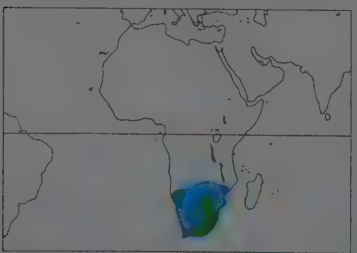
Spanish: Buitre de El Cabo

Other common names: Cape/Kolbe's Vulture

Taxonomy. *Vultur Coprotheres* J. R. Forster, 1798, South Africa.

Forms superspecies with *G. fulvus* and *G. rueppellii*, and possibly also with *G. himalayensis* and *G. indicus*. Sometimes considered conspecific with *G. fulvus*. Monotypic.

Distribution. Centred on Lesotho and South Africa, extending to Namibia, Botswana, Zimbabwe, S Mozambique and Swaziland, rarely wandering N to Zambia.



Descriptive notes. 110 cm; 7070-10,900 g, mean 9350 g; wingspan 255 cm. Pale plumage contrasts with dark spots along trailing edge of wing-coverts and dark flight-feathers. Most like *G. fulvus* but neck and bill colour differ. Bill black at all ages; adult has eye golden and neck and coracoid skin patches blue. Juvenile has eye brown and neck pink.

Habitat. Open grassland, steppe and, historically, karoooid vegetation, in the proximity of mountains for orographic lift and cliffs for roosting and nesting sites. Peripheral N colonies in bush savanna.

Food and Feeding. Carrion and bone fragments of larger carcasses, mainly soft muscle and organ tissue. Colonial and gregarious, feeding and fighting among other vultures to obtain flesh, even inserting the long bare neck under the skin or crawling into the rib-cage. Often soars in groups, using behaviour of conspecifics to help locate food. After feeding, usually bathes communally at favourite sites.

Breeding. Laying Apr-Jul. Breeds colonially on cliff faces with 1-1000 pairs building stick platforms lined with grass on open ledges. Single egg (rarely 2); incubation 55 days; chick has white down; parents take turns with care of egg and chick; fledging mean 140 days. Known to have lived over 11 years.

Movements. Most birds remain within foraging range of about 100 km of nesting and roosting colonies. Some disperse over long distances throughout S African subcontinent (e.g. into Zambia and C Mozambique), especially juveniles which concentrate in nursery areas remote from colonies.

Status and Conservation. RARE. CITES II. At least 83 colonies and 4400 breeding pairs estimated to remain, but has undergone range retraction and loss of peripheral colonies; declines continue at some major colonies. Most studied, monitored and conserved of African vulture species. Historically affected by elimination of carnivores and game, possibly initiating skeletal abnormalities in chicks, through lack of bone flakes in diet. Has recently been suffering from persecution and poisoning, collection for traditional medicines, electrocution and drowning in water tanks. Conservation efforts include provision of food and bone flakes at "vulture restaurants" and attempts to control limiting agents. Not obviously affected by pesticides.

Bibliography. Benson *et al.* (1990), Borello (1985, 1986), Borello & Borello (1993), Boshoff & Currie (1981), Boshoff & Robertson (1985), Boshoff & Vernon (1980b), Brooke (1984), Brown, C.J. (1985b), Brown, C.J. & Piper (1988), Brown, L.H. *et al.* (1982), Collar & Andrew (1988), Collar & Stuart (1985), Dobbs & Benson (1984), Ginn *et al.* (1989), King (1978/79), Komen (1991a, 1992), Ledger & Annegarn (1980), Mackworth-Præd & Grant (1962), Maclean (1993), Mundy (1982, 1983), Mundy & Ledger (1976), Mundy, Ledger & Friedmann (1980), Mundy, Grant *et al.* (1982), Mundy, Butchart *et al.* (1992), Pickford *et al.* (1989), Piper & Ruddle (1986), Richardson *et al.* (1986), Robertson, A.S. (1986), Robertson & Boshoff (1986), Robertson & February (1986), Steyn (1982), Tarboton & Allan (1984), van Wyk *et al.* (1993).

Genus AEGYPIUS Savigny, 1809

55. Eurasian Black Vulture

Aegypius monachus

French: Vautour moine

German: Mönchsgeier

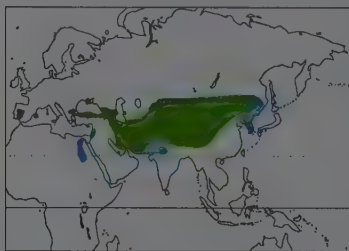
Spanish: Buitre Negro

Other common names: Cinereous Vulture, (European) Black Vulture(!)

Taxonomy. *Vultur Monachus* Linnaeus, 1766, Arabia.

Sometimes considered to be congeneric with genera *Torgos*, *Sarcogyps* and *Trigonoceps*. Possible races *chincoulchinou* of China and *danieli* of Mongolia not generally recognized. Monotypic.

Distribution. S Palearctic, from Spain, Balearic Is and Balkans through Turkey, Caucasus, Iran and Afghanistan to S Siberia, Mongolia, N China and extreme N India. Winters S to Sudan, Middle East, Pakistan, NW India and Korea.



Descriptive notes. 98-107 cm; 7000-12,500 g; wingspan 250-295 cm. Huge, broad-winged vulture, often slightly wedge-shaped tail; all dark sooty to black. One of largest Old World vultures. Bare skin of head and neck bluish grey; head covered with blackish down; neck ruff paler in older birds. Immature somewhat blacker, and top of head covered with black down; juvenile has bare skin pink.

Habitat. Forested areas in hills and mountains, at 300-1400 m in Spain, but higher in Asia. In Tibet and China, two different eco-geographical types: mountainous forest and scrub between 780 m and 3800 m; and arid and

semi-arid alpine meadows and grassland, between 3800 m and 4500 m. In Nurata Mts, Uzbekistan, breeds at altitude of 900-1900 m. Forages over forested areas, but also over many kinds of open terrain from steppe to upland grasslands.

Food and Feeding. Feeds on carrion, from medium-sized to large carcasses; only rarely takes live prey, e.g. lizards and tortoises. In S Spain, feeds basically on mammals, including 90% rabbits and sheep, but insects and lizards also appear in diet; here, increase of wild ungulate populations has changed diet, so that such species are now important. In Mongolia, sometimes found in large numbers in areas affected by Tarbagan pest, a disease of Bobak marmot (*Marmota bobak siberica*); also takes prey from *Aquila nipalensis*. In Tibet, feeds on carcasses of wild yaks, blue sheep, Tibetan gazelles, kiang, woolly hare and Himalayan marmots, together with domestic yak, sheep, and sometimes even corpses of human beings put out on "celestial burial platforms". Generally dominant at carcasses; heavy bill capable of tearing through muscles, tendons and skin.

Breeding. Laying in Feb-Apr. Tends to congregate in very loose colonies or nuclei; in Spain occupied nests 30 m to 2 km apart; density of 1.7-2.0 pairs/1000 ha in Nurata Reserve, 300 km SE of Tashkent (Uzbekistan); 5 pairs in 100 km² in Kentei Mts, Mongolia. Nests usually (1.5-5 m up) in trees: in Spain, mainly evergreen oaks (*Quercus*) and pines (*Pinus*); in Armenia, Azerbaijan, Kopet-Dag, Tien Shan and Baluchistan, mainly junipers (*Juniperus*); in Uzbekistan, often on Buchara almond (*Amygdalus bucharica*); nests on rocks extremely rarely in Europe, but more often in parts of Asia, e.g. Tien Shan. Enormous stick nest 145-190 cm wide, 95-300 cm deep, often occupying much of tree. 1 egg, extremely rarely 2 (0.76%); in C Asia, clutch size averages 1.01 eggs (per laying); incubation usually 54-56 days (50-62); chicks have grey down, paler on head; fledging 95-110 days in Spain, 104-120 days in C Asia. Hatching success 90%, and high overall nesting success in Spain, but much pairs do not breed every year. Breeding success in Nurata Mts (Uzbekistan) 0.57 young per pair. In captivity has lived to 39 years old.

Movements. In S Europe adults non-migratory, in C Asia semi-resident, often following nomads and their domestic herds. Partly migratory in Asia: most birds leave Mongolia and other N breeding areas for winter; migrants winter from NE Africa and Middle East through N India to Korea; some birds reach Arabia and S China.

Status and Conservation. VULNERABLE. CITES II. Threatened at world level, partly because nests on trees which are often easily accessible. In many areas, the forests where it breeds have been cut down or will be destroyed in near future. Also suffering from lack of food, poisoning, direct persecution, etc. Has declined or disappeared from much of former range in W; exception is Spain, where species increased from 200 pairs in 1970 to 900-1000 pairs in 1992, after major conservation efforts; 85% of population now in protected areas. In Mallorca (Balearic Is), increased from 20-22 birds in 1966 to 57 birds in 1991, as result of releases. In France, 9 birds released in 1992 and 1993. Now extinct in Morocco, Portugal, Italy, former Yugoslavia, Albania, Romania, Moldova and Israel. Tiny remnant populations in Greece (c. 16 pairs), Bulgaria (1 pair), Ukraine, in Crimea (3-6 pairs, from 15-20 in 1950's) and Turkey (very rare). Presently c. 50 pairs in European Russia; 60-80 pairs in Azerbaijan, and probably c. 40-70 pairs in Georgia and Armenia. No exact information further E, but probably over 1000 pairs in Asian part of former USSR; regularly observed in C Asia and Mongolia. Even in Tibet, where Qinghai, Xizang and Ganan are refuge areas for species because Tibetans protect it, chemical pesticides used against rodents have led to poisoning of vultures and decline in breeding rates. Many vultures also trapped or shot in China

for trade in their feathers. Problem of collecting live specimens is becoming especially acute in former USSR.

Bibliography. Akimov (1940), Ali & Ripley (1978), Baumgart (1974, 1981), Bergier (1987), Bemis (1966), Brazil (1991), Brown *et al.* (1982), Collar & Andrew (1988), Cramp & Simmons (1980), Dementiev & Gladkov (1951), Diebold (1993), Donazar (1993), Elsegui (1970, 1971), Esquivias *et al.* (1980), Etchécopar & Hùe (1978), Faust (1964), Fischer (1974, 1983b), Flint *et al.* (1984), Gejlikman (1992), Gënsbøl (1986), Gëroudet & Grubler (1967), González (1991), Grubb (1973), Handrinos & Demetropoulos (1983), Hiraldo (1974, 1976, 1983), Iankov, Khristov & Avramov (1994), Korshunov & Korshunova (1985), Kozlova (1975), Mackworth-Praed (1957), Mayol (1975, 1977a), Meier (1982), Meyburg (1976, 1989b), Meyburg & Meyburg (1983, 1984), Minnemann & Busse (1984), Mundy *et al.* (1992), Patrikeev (1993), Paz (1987), Reise (1907), Rettig (1911), Richford (1976), Richford & Stewart (1975), Richforde & Platt (1982), Roberts (1991), Rogacheva (1992), Rozanov (1931), Shagdasuren (1964), Shibeve (1981), Shirihai & Yekutieli (1991), Simeonov *et al.* (1990), Skinner (1925), Sluudskij (1962), Suarez (1973), Suchinin (1958), Suetsens & van Groenendaal (1966, 1967), Sushkin (1938), Tewes (1994), Valverde (1966), Vasvari (1935), Vinogradov (1963), Waters & Prytherch (1968), Ye Xiao-Ti (1991).

Genus *TORGOS* Kaup, 1828

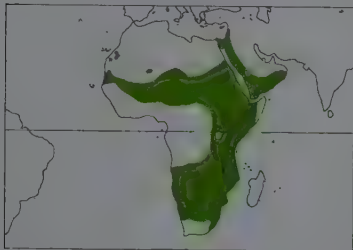
56. Lappet-faced Vulture

Torgos tracheliotus

French: Vautour oricou **German:** Ohrengerier **Spanish:** Buitre Orejudo
Other common names: African Black/King Vulture, Nubian Vulture

Taxonomy. *Vultur tracheliotus* J. R. Forster, 1791, Great Namaqualand, South Africa. Usually considered sufficiently distinctive to merit monotypic genus, but sometimes placed in *Aegypius* along with *A. monachus*, *T. occipitalis* and *S. calvus*, and in superspecies with *A. monachus*. Validity of races questionable, as variation may be largely individual and clinal. Three subspecies recognized.

Subspecies and Distribution.
T. t. tracheliotus (J. R. Forster, 1791) - extreme SW Morocco; S Mauritania E to Ethiopia and Kenya, S to South Africa.
T. t. nubicus (H. Smith, 1829) - Egypt and N Sudan.
T. t. negevensis Bruun *et al.*, 1981 - S Israel and Arabian Peninsula.



Descriptive notes. 115 cm; 5400-9400 g, mean 6780 g; wingspan 280 cm. Very large, although size often exaggerated: in E Africa, averages considerably lighter (6200 g) than sympatric *G. rueppellii* (7400 g). Colour of head and exposure of lappets partly dependent on mood and temperature. White down on adult's patagia and thighs forms distinctive flight pattern. Juvenile brown with some down on head, dark horn-coloured head and no pale areas on underparts. Races recognized on extent of lappets and bald head, and on colour of bill and thighs, but considerable individual variation may be clinal; *negevensis* has patagia buff-coloured.

Habitat. Steppe and desert, where isolated flat-topped trees provide nest-sites; also extends into more mesic open savanna and woodland, breeding up to 2800 m.

Food and Feeding. Carrion, skin and bone fragments from large and small carcasses; takes up to 1450 g in one meal. Mainly scavenges; credited with killing some small animals but may pirate from other raptors. Usually in pairs, but up to 50 birds may gather with other vultures at larger carcasses or at water. Large, broad wings with low wing-loading allow relatively early ascent and slow searching flights. May dominate all other scavenging birds at a carcass, with bounding attack display, but often spends more time in social interaction than feeding, returning later to use heavy bill for rending skin and sinew.

Breeding. Laying usually in dry season: Oct-Jan in W Africa, Dec-Feb in NE Africa and Middle East, Feb-Jul in E Africa, Apr-Aug in S Africa. Builds extensive platform of sticks, lined with dry grass, usually on a short, exposed thorny tree. Several nests from previous attempts may be found nearby, and pairs nest either alone or somewhat clumped within an area of suitable habitat. Single egg (rarely 2); incubation 54-56 days; chick has first down white and second down grey; fledging 125-135 days; may still be fed regularly by parents a year after fledging.

Movements. No regular movements described, except for W Africa where apparent shift N during the rains and S during the dry season. Adults may forage over 200 km from the nest, and juveniles known to have dispersed at least 700 km.

Status and Conservation. Not globally threatened. CITES II. Thinly scattered as a breeding species throughout its wide range, with concentrations of up to c. 40 pairs found only in Namibia, Botswana, Zimbabwe, South Africa, Tanzania and possibly Arabia. Decline in NE Africa during 1930's, and more recently in Algeria, and now extinct in both areas; also range reduction in South Africa and Namibia, where poisoning implicated, and in Sudan. Only one pair out of at least 30 remained in Israel by 1989, and only 10 pairs in Upper Egypt, suggesting that the relatively small population of race *negevensis* might be vulnerable, but a good number of breeding pairs recently discovered occupying substantial part of interior of Saudi Arabia. A small captive breeding population exists at Tel Aviv (Israel).

Bibliography. Anthony (1976), Bannerman (1953), Benson & Benson (1975), Bergier (1987), Brown, C.J. (1986b, 1988b), Brown, L.H. *et al.* (1982), Bruun (1981), Bruun *et al.* (1981), Cramp & Simmons (1980), Gënsbøl (1986), Ginn *et al.* (1989), Goodman *et al.* (1989), Gore (1990), Herholdt & de Villiers (1989), Houston (1989), Hustler & Howells (1988a), Jennings (1982), Leshem (1984), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Mundy (1982), Mundy *et al.* (1992), Newton & Shobrak (1993), Paz (1987), Pennycook (1976), Pickford *et al.* (1989), Pinto (1983), Richardson (1990), Shirihai & Yekutieli (1991), Steyn (1982), Tarboton & Allan (1984), Weigelt & Schulz (1992), Wilson, R.T. (1982).

Genus *TRIGONOCEPS* Lesson, 1842

57. White-headed Vulture

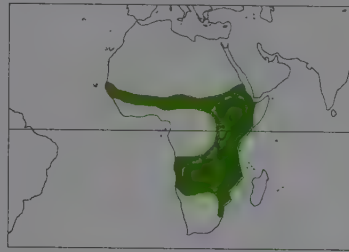
Trigonoceph occipitalis

French: Vautour à tête blanche **German:** Wollkopfgeier **Spanish:** Buitre Cabeciblanco

Taxonomy. *Vultur occipitalis* Burchell, 1824, Matlowing River, Botswana.

Usually considered sufficiently distinctive to merit monotypic genus, but sometimes placed in genus *Aegypius* with *A. monachus*, *T. tracheliotus* and *S. calvus*. Monotypic.

Distribution. Senegal E to Ethiopia (including Dahak Archipelago) and Somalia, then S to Namibia and N South Africa.



Descriptive notes. 85 cm; 3300-5300 g, mean 4260 g; wingspan 230 cm. Pied plumage, angular head, high neck ruff and bright facial colours notable. Both sexes have greater underwing-coverts tipped white, but only female has white inner secondaries (from first post-juvenile moult; most evident in flight. Juvenile fledges with white down on head, which then becomes dark brown all over, with paler facial colours than adult, somewhat like juvenile *Torgos tracheliotus*.

Habitat. Dry woodland and tree savanna, not extending into drier steppe or denser forest areas.

Food and Feeding. Carrion and bone fragments from carcasses large and small. Feeds alone or in pairs, rarely more than two pairs congregating at larger carcasses; prefers to snatch a chunk from another species and then feed sedately nearby. Often first at a kill, or follows an eagle or another early-arriving scavenger e.g. *Terathopus ecaudatus*. Credited with killing some small or weak prey, but may also rob or scavenge from other raptorial birds. Includes termite alates or locusts in the diet when available.

Breeding. Laying usually in the dry season: Oct-Jan in W and NE Africa; all months in E Africa, depending on rainfall patterns; May-Aug in S Africa. Builds rather deep stick platform on crown or open upper fork of a tall tree, often in a conspicuous position, made more so by the adults perching on the nest for long periods. Single egg; incubation 55-56 days; chick has white down; fledging 115-120 days. One remarkable record of incubation and rearing in wild by *Torgos tracheliotus*.

Movements. No regular movements of adults reported, even in W Africa. Adult pairs apparently sedentary within a limited home range, possibly territorial. Adults may be most sedentary of African vultures, but wide juvenile dispersal expected and indication of juvenile movements with rains in W Africa and Chad.

Status and Conservation. Not globally threatened. CITES II. Generally uncommon, at 0.25-1.2 birds/100 km of road counts, with highest values of up to 9.3 birds/100 km from woodland-grassland mosaic in Cameroon and Uganda. Estimated 130 pairs in South Africa, 80 in Hwange National Park, Zimbabwe. Up to 61% of pairs do not attempt breeding every year, especially during periods of below average rainfall.

Bibliography. Anthony *et al.* (1980), Bannerman (1953), Benson & Benson (1975), Brooke (1984), Brown *et al.* (1982), Ginn *et al.* (1989), Gore (1990), Grimes (1987), Houston (1989), Howells & Hustler (1984), Hustler & Howells (1988b), Koenig (1979), Kruuk (1967), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Mundy (1982, 1985a, 1987), Mundy *et al.* (1992), Pennycook (1976), Pickford *et al.* (1989), Pinto (1983), Richardson (1984), Steyn (1982), Tarboton & Allan (1984), Thiollay (1978c).

Genus *SARCOGYPS* Lesson, 1842

58. Red-headed Vulture

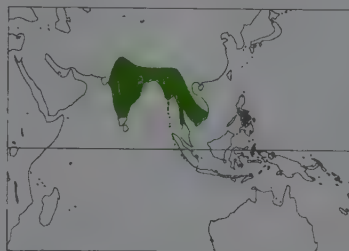
Sarcogyps calvus

French: Vautour royal **German:** Kahlkopfgeier **Spanish:** Buitre Cabecirrojo
Other common names: (Indian/Asian) King/Black Vulture, Pondicherry Vulture

Taxonomy. *Vultur calvus* Scopoli, 1786, Pondicherry, India.

Sometimes placed in *Aegypius* or *Torgos*, but probably distinctive enough to merit its own monotypic genus. Monotypic.

Distribution. E Pakistan through India, except extreme S, and Nepal to SC China (S Yunnan). Burma, Indochina and N Malay Peninsula.



Descriptive notes. 76-84 cm; 3600-5400 g; wingspan 218-229 cm. Medium-sized, jet black vulture; pale grey band across base of flight-feathers from above and below. Red head and legs; lappets on sides of neck; in flight, white flank spots and tapered wing shape distinctive. Iris pale (white to yellowish) in adult male, dark in female. Juvenile dark brown with dark eye; in flight, shows distinctive white patches, while wing shape similar to *Gyps* vultures.

Habitat. Wide variety of habitats, including open countryside, cultivated areas, savanna woodland, and foothills up to 2000 m; often in proximity of human habitation.

Food and Feeding. Usually feeds on carrion; also pirates food from other vultures, especially *Neophron perenopator*, and perhaps from other raptors. Attends carcasses in company of other vultures, but usually less numerous; generally rather timid at carcasses.

Breeding. Season mainly Dec-Apr, with most laying in Jan-Feb. Large nest built by pair 9-12 m up large tree, often at top; in desert areas, nest placed 2-3 m up on top of smaller bushes; nest is lined with green leaves. Display flights more acrobatic than those of other Asian vultures, with mutual soaring and cartwheeling. Pairs territorial, excluding conspecifics. Usually 1 egg; incubation c. 45 days, by both sexes; chick has greyish white down; fledging and dependency periods unknown.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES II. Because territorial, never as numerous as other sympatric vulture species. Fairly common in Nepal and in many parts of India. Declining in Gujarat (W India), Malay Peninsula and perhaps elsewhere; most likely causes are decrease in availability of food and also direct persecution. Apparently rare on periphery of range in Yunnan (SC China) and Pakistan.

Bibliography. Ali & Ripley (1978), Cheng Tso-hin (1987), Deignan (1945, 1963), Etchécopar & Hùe (1978), Humphrey & Bain (1990), Inskipp & Inskipp (1985), Khaichar & Mundkur (1989), King *et al.* (1975), Lekgall & Round (1991), Madoc (1976), Medway & Wells (1976), Meyer de Schauensee (1984), Riley (1938), Roberts (1991), Round (1988), Smythies (1986).



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ssp cheela

ssp bido

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ssp perplexus

ssp abbotti

ssp natunensis

ssp sipora

ssp natunensis

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ssp asturinus

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ssp batesi

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ssp spectabilis

PLATE 8

inches 14
cm 35

Genus *CIRCAETUS* Vieillot, 1816

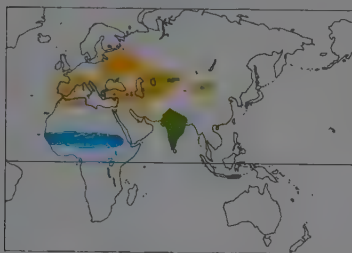
59. Short-toed Snake-eagle

Circaetus gallicus

French: Circaète Jean-le-Blanc **German:** Schlangenadler **Spanish:** Culebrera Europea
Other common names: Short-toed Eagle

Taxonomy. *Falco gallicus* Gmelin, 1788, France.

Forms superspecies with *C. beaudouini* and *C. pectoralis*, both of which are frequently considered races of present species, due to occurrence of mixed pairs in zones of overlap. Population of Lesser Sunda is racially distinct; averages somewhat smaller and may have different timing of moult, but remains little known at present. Name *C. ferox* formerly applied, but is unidentifiable. Monotypic. **Distribution.** NW Africa and SW Europe N to Gulf of Finland and E to L Balkash and Iran; Indian Subcontinent; Lesser Sunda (from Lombok to Timor). W populations winter in Sahel zone.



Descriptive notes. 62-67 cm; male 1200-2000 g, female 1300-2300 g; wingspan 170-185 cm. Plumage rather variable; typical contrast of dark head and upper breast with white underparts ranges from very conspicuous (re-calling *C. pectoralis*) to non-existent; brown barring on underparts equally variable. Large head; yellow iris; 3-4 bands on tail; upperparts mainly greyish brown, generally paler than in *C. beaudouini* and much paler than *C. pectoralis*. Juvenile similar to adult.

Habitat. Varied habitats mainly in warm temperate and tropical zones; from open woodland and even fairly dense forest to semi-desert.

Often occurs in areas with mixed habitats: requires fairly open areas rich in reptiles, e.g. stony areas with sparse vegetation cover, pastures, scrub; also, nearly always requires tree cover of some sort, e.g. small woods or scattered trees. From plains and hilly country to mountains; hunts up to tree-line and above; in Morocco breeds up to 2300 m. Nests in very wide range of woodland types, including both coniferous and deciduous. Perches on vantage points, e.g. trees, bluffs, pylons.

Food and Feeding. Specializes in reptiles, particularly snakes, which constitute 70-80% of prey or more. Regional variation in species: mainly non-venomous species, especially Colubridae, up to 150+ cm in length. Also takes other reptiles, particularly lizards, including monitors (*Varanus*), chameleons, geckos, slow-worms and skinks; occasionally mammals, e.g. rodents, shrews, rabbits, hares, hedgehogs; also amphibians; few birds and invertebrates. Probably takes fewer reptiles during bad weather and when recently arrived on breeding grounds. Normally hunts in open areas, but sometimes in dense vegetation; forages at medium height or remarkably high up (normally 20-150 m), with gliding or soaring flight; to survey terrain more closely, hovers on wind or with wings beating, "parachuting" down on prey, once located, often with a brief final hover. Swallows snakes and lizards whole, head first; but head may be crushed or torn off prior to consumption, and large snakes can be torn to pieces before being eaten; part of prey sometimes sticks out of bill, when bird already in flight.

Breeding. Lays in Apr in S Europe and Morocco; Jan-Feb in Indian Subcontinent; young bird in Oct in Lesser Sunda. Nests almost exclusively in trees, rarely very tall, often only a few metres in height; very rarely nests on cliff ledges; sometimes uses nest of other raptors or corvids. Nest built on crown of tree or on lateral branch; small for size of species, often no more than 50 cm wide, c. 30 cm deep; built of sticks and twigs, and lined with green leaves or grass. Pair-bond probably maintained in both migratory and sedentary populations, but new nest normally built each year. 1 egg; replacement clutch rare; incubation 45-47 days, mainly by female; chick has white down; cared for and fed by both adults; at first given small bits of food, but later learns to pull prey out of adult's crop, and swallow it whole; fledging 60-80 days; independent, leaving parents' territory soon after. Breeding success in C Italy of 0.75 chicks fledged per pair. Oldest recorded bird 17 years old.

Movements. Migratory in Palearctic; sedentary in India, Pakistan and Lesser Sunda. Most migrants winter in tropical N Africa, from Senegambia to Ethiopia; E birds winter in Indian Subcontinent, occasionally in SE Asia. Exceptional in winter in S Europe, N Africa and Middle East; more common in Arabian Peninsula. Most birds leave Europe from mid-Sept to mid-Oct, returning during Mar and first half of Apr. Birds gather at crossing points: main route between Africa and Europe passes over Straits of Gibraltar; between Africa and Asia over Gulf of Suez. Vagrant to Malay Peninsula; one probable record from E Java.

Status and Conservation. Not globally threatened. CITES II. Declined markedly in past, disappearing from most of C & N Europe in 19th century; possibly stable at end of 20th century. In Europe and Asia, affected very little by pesticides, and generally suffers less from shooting than sedentary raptors, although on Malta even in 1993 all 50 birds that arrived on single day were shot. Long-term population trends probably depend on habitat changes resulting from intensification of farming, etc. Estimates in 1980's: 1000-2000 pairs in Spain; 80-100 pairs in Portugal; c. 1000 pairs in France; 380-415 pairs in Italy; perhaps 200 pairs in former Yugoslavia; over 300 pairs in Greece; c. 50-70 pairs in Bulgaria; c. 30-100 pairs in Romania; c. 45-50 pairs in Hungary; c. 20-30 pairs in Poland; over 1000 pairs in Morocco; and over 200 pairs in Tunisia. Estimates from early 1990's include: 1000 pairs in European Russia; 200-250 pairs in Byelorussia; and sizeable population in Ukraine, where declining due in part to deforestation. Very little information on Asian populations: perhaps 100-200 pairs in Israel; and 100-1000 pairs in Turkey, although maximum alternatively estimated at c. 8000 pairs; the 12,000 birds seen in Suez in autumn 1984 must correspond to populations occupying E Europe and most of Asia. In Pakistan, widespread and locally quite common, but generally rather sparsely distributed. Status in Lesser Sunda virtually unknown, but very few records, so species almost certainly uncommon, at best; until recently thought to be mere migrant to these islands, but breeding proved in 1971.

Bibliography. Ali & Ripley (1978), Amores & Franco (1981), van Balen & Compost (1989), Bergier (1987), Boudouin (1953), Boudouin *et al.* (1953), Brown, L.H. (1974a, 1976b), Brown *et al.* (1982), Cramp & Simmons (1980), Dementiev & Gladkov (1951), Eichécopar & Hude (1978), Flint *et al.* (1984), Gensbøl (1986), Goodman *et al.* (1989), Handrinos & Demetropoulos (1983), Knystautas (1993), Król (1983), Mackworth-Præd & Grant (1957-1973), Olech (1991), Paz (1987), Petreñ (1988), Richardson (1990), Roberts (1991), Rocamora (1994b), Shirahai & Christie (1992), Simeonov *et al.* (1990), Thiollay (1989), White & Bruce (1986).

60. Beaudouin's Snake-eagle

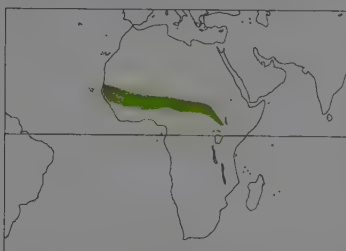
Circaetus beaudouini

French: Circaète de Beaudouin **Spanish:** Culebrera Sudanesa
German: Beaudouin-Schlangenadler
Other common names: Beaudouin's Harrier-eagle

Taxonomy. *Circaetus beaudouini* J. Verreaux and Des Murs, 1862, Bissau, Guinea-Bissau.

Often considered conspecific with *C. gallicus* and *C. pectoralis*, as some mixed pairs occur; these three species form superspecies. Monotypic.

Distribution. S Mauritania and Senegambia E to SW Sudan, N Uganda and NW Kenya.



Descriptive notes. 60 cm. Generally shows darker upperparts and bolder flight-feather markings than *C. gallicus*, while dark bars in tail tend to be more pronounced; underparts pale grey-brown with fine white barring. Most resembles intermediate immature plumage of *C. pectoralis*, of which adult much darker and more pied, and which may confound reports of hybridization. Juvenile much paler than congeners, almost white on head and neck.

Habitat. Open woodland and tree savanna, possibly overlapping in NW Kenya with *C. pectoralis*, which tends to occur in more open habitats.

Food and Feeding. Mainly snakes, but also other small vertebrates when necessary. Hunts from a prominent perch more often than its nearest relatives; also forages by means of soaring flight that is interrupted at intervals to hover. Often perches on edge of woodland, and generally more static in behaviour than its close relatives.

Breeding. Laying Nov. Virtually unstudied but probably similar to *C. gallicus* and *C. pectoralis*. Builds small inconspicuous stick nest on crown of tree. Single egg; other details unrecorded.

Movements. A regular seasonal migrant between moist wooded savannas and the Sahel; most birds move N in rains and S in dry season, in association with grass fires and reduced ground cover. In some areas, patterns of movement have been masked by confusion with *C. gallicus*.

Status and Conservation. Not globally threatened. CITES II. Generally uncommon. Most limited range of any *Circaetus* eagle, and if a good species must be considered vulnerable as it inhabits the generally degraded habitats of the Sahel zone. Not known to be affected by pesticides or seriously persecuted.

Bibliography. Brown, L.H. (1974a), Brown *et al.* (1982), Browne (1981), Gore (1990), Grimes (1987), Lewis & Pomeroy (1989), Morel & Morel (1990), Serle (1943), Serle *et al.* (1977), Snow (1978), Thiollay (1975c, 1978c, 1985d).

61. Black-breasted Snake-eagle

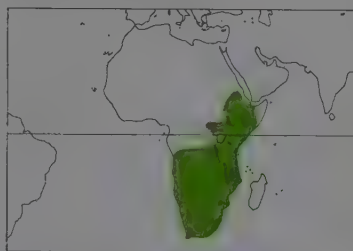
Circaetus pectoralis

French: Circaète à poitrine noire **Spanish:** Culebrera Pechinegra
German: Schwarzbrust-Schlangenadler
Other common names: Black-chested Snake-eagle, Black-breasted Harrier-eagle

Taxonomy. *Circaetus* [sic] *Pectoralis* A. Smith, 1829, South Africa.

Often considered conspecific with *C. gallicus* and *C. beaudouini*; these three species form superspecies. Monotypic.

Distribution. E Sudan and Ethiopia S to South Africa.



Descriptive notes. 65 cm; 1178-2260 g; wingspan 178 cm. Pied plumage of adult and yellow eye similar to adult *Polemaeus bellicosus*, but underwing mainly white not black and underparts unspotted. Juvenile plumage brown, similar to *C. cinereus* but more cinnamon below; present species usually perches more horizontally. Intermediate immature plumage similar to adult, but browner with brown scallions on white underparts.

Habitat. Open areas of savanna and steppe, extending into deserts and clearings in woodland, but absent from forested areas.

Food and Feeding. Mainly snakes and lizards but takes rodents, amphibia, arthropods, even small birds, bats and fish, more than other snake-eagles. Perch-hunts for long periods but also spends much time on the wing soaring in search of prey, interspersed with bouts of hovering. Up to 200 individuals may roost communally when not breeding, spreading out during the day to hunt solitary, less often gregariously when prey locally abundant e.g. rodents or locusts. Often consumes prey in flight; snakes swallowed but left hanging from bill, when delivered to nest.

Breeding. Laying during dry season: Nov-May in NE and E Africa; May-Jan in C Africa; Mar-Oct in S Africa. Builds small platform of thin sticks on the crown of a tree, often a small, isolated one and generally secretive when nesting; rarely nests on a power pylon. Single egg; incubation 51-52 days; chick has white down; fledging 89-90 days.

Movements. Known to be highly nomadic and possibly even makes regular intra-African migrations: a non-breeding visitor, moving regularly into several areas, or numbers fluctuating considerably in others, but details unclear.

Status and Conservation. Not globally threatened. CITES II. Widespread and often locally common. Broad habitat tolerance, mobility, secretive breeding and use of man-modified areas all bode well for its future. Not known to be affected by pesticides.

On following pages: 62. Brown Snake-eagle (*Circaetus cinereus*); 63. Southern Banded Snake-eagle (*Circaetus fasciolatus*); 64. Western Banded Snake-eagle (*Circaetus cinerascens*); 65. Bateleur (*Terathopius ecaudatus*); 66. Crested Serpent-eagle (*Spilornis cheela*); 67. Great Nicobar Serpent-eagle (*Spilornis klossii*); 68. Kinabalu Serpent-eagle (*Spilornis kinabaluensis*); 69. Sulawesi Serpent-eagle (*Spilornis rufpectus*); 70. Philippine Serpent-eagle (*Spilornis holospilus*); 71. Andaman Serpent-eagle (*Spilornis elginti*); 72. Congo Serpent-eagle (*Dryotriorchis spectabilis*); 73. Madagascar Serpent-eagle (*Eutriorchis astur*).

Bibliography. Allan (1988b), Benson & Benson (1975), Britton (1980), Brown, L.H. (1974a), Brown *et al.* (1982), Colebrook-Robjent & Aspinwall (1986), Dowsett & Dowsett-Lemaire (1980), Ginn *et al.* (1989), Lewis & Pomeroy (1989), Maclean (1993), Pickford *et al.* (1989), Pinto (1983), Steyn (1966, 1982), Turboton & Allan (1984).

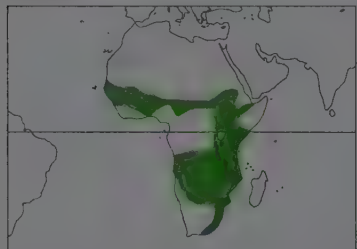
62. Brown Snake-eagle

Circaetus cinereus

French: Circaète brun **German:** Einfarb-Schlangennadler **Spanish:** Culebrera Sombria
Other common names: Brown Harrier-eagle

Taxonomy. *Circaetus cinereus* Vieillot, 1818, Senegal. Monotypic.

Distribution. Senegambia E to N Ethiopia and S to South Africa.



Descriptive notes. 75 cm; 1540-2465 g; wingspan 164 cm. Dark brown colour and upright stance distinguish from juvenile *C. pectoralis* or from *C. beudouini*. Underside of flight-feathers silvery white against dark coverts. Juvenile slightly paler; intermediate immature plumage with few spots and bars of white on underparts.

Habitat. Woodland and tree savanna, especially where low hills protrude, less often extending into drier steppes.

Food and Feeding. Snakes, including large and poisonous species, and a few large lizards; rarely rodents or gamebirds. Hunts primarily from a perch on top of a prominent tree, often on a hill, making long strikes at prey or infrequent changes of perch. Only rarely hunts from foraging flight or after hovering briefly. Usually consumes prey on the ground. Sometimes attracted by small birds mobbing a predator.

Breeding. Laying Nov-Feb in W Africa and NE Zaire; Feb-May in E and C Africa; Jul-Mar in S Africa. Builds small platform of thin sticks on crown of tree, succulent plant, epiphyte, buffalo-weaver (*Bubalornithinae*) nest, or rarely a power pylon, often on the old nest of another raptor. Secretive when breeding. Single egg; incubation 48-50 days; chick has white down; fledging 97-113 days.

Movements. Resident and sedentary in many areas, but long distance ringing recoveries (up to 2100 km) and fluctuations in numbers in S and E Africa suggest some intra-African movements. In W Africa may move S in dry season and N when rains increase ground cover.

Status and Conservation. Not globally threatened. CITES II. Widespread and conspicuous but often at low density, such as 1 pair/200 km² in Kenya. Vulnerable to clearing of woodland and lowering of primary productivity through overgrazing. Not known to be affected by pesticides.

Bibliography. Allan (1988b), Benson & Benson (1975), Britton (1980), Brown, L.H. (1976b), Brown *et al.* (1982), Colebrook-Robjent & Aspinwall (1986), Ginn *et al.* (1989), Gore (1990), Grimes (1987), Lewis & Pomeroy (1989), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Pickford *et al.* (1989), Pinto (1983), Steyn (1964, 1972a, 1975a, 1982), Turboton & Allan (1984), Thiollay (1978c).

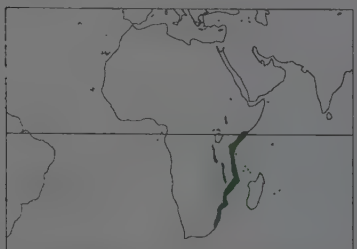
63. Southern Banded Snake-eagle

Circaetus fasciolatus

French: Circaète barré **German:** Graubrust-Schlangennadler **Spanish:** Culebrera Barreada
Other common names: Fasciolated/Fasciated/East African Snake-eagle

Taxonomy. *Circaetus fasciolatus* Kaup, 1847, Natal, South Africa. Monotypic.

Distribution. Kenya to NE South Africa along the E coast of Africa and further inland along major rivers.



Descriptive notes. 60 cm; 908-1110 g. Barred underparts and three white bars on long tail distinguish from *C. cinerascens*. A highly vocal species, especially when adult. Juvenile dark brown above and white below, flecked with buff and streaked with black respectively. Intermediate plumage not described.

Habitat. Dense coastal and riverine forest, ranging into savanna adjoining marshes and floodplains.

Food and Feeding. Mainly small snakes and lizards, also some rodents, amphibians, arthropods and birds. Secretive and solitary, usually perching within the canopy when hunting, less often in the open. Changes perch infrequently and rarely soars above forest.

Breeding. Laying Jul, Oct in E Africa; Sept-Oct in S Africa. Builds small stick nest in upper fork of forest tree, deep within canopy, and often well hidden among creepers. Single egg; incubation and fledging periods unrecorded.

Movements. Sedentary and resident throughout limited range, except for some movement N into Kenya in dry season May-Sept.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Locally common, but habitat often patchy and restricted. Secretive nature and reptilian diet do not attract persecution; often hunts on edges of small agricultural clearings. Vulnerable to cutting and degradation of forest habitat, especially along rivers. Not known to be affected by pesticides.

Bibliography. Benson & Benson (1975), Britton (1980), Brown, L.H. (1969, 1976b), Brown *et al.* (1982), Clancey (1987a, 1990), Danell (1965, 1966a), Ginn *et al.* (1989), Krueger (1967), Lewis & Pomeroy (1989), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Pickford *et al.* (1989), Steyn (1982), Zimmerman (1970).

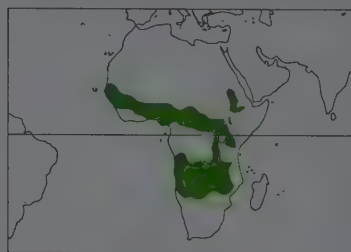
64. Western Banded Snake-eagle

Circaetus cinerascens

French: Circaète cendré **German:** Bandschlangennadler **Spanish:** Culebrera Coliblanca
Other common names: (Smaller) Banded Snake-eagle, Banded Harrier-eagle

Taxonomy. *Circaetus* [sic] *cinerascens* J. W. von Müller, 1851, Sennar, Sudan. Monotypic.

Distribution. Senegambia E to S Sudan and W Ethiopia, then S to R Zambezi, occurring S to Angola and Namibia in W, and Zimbabwe and Zambia in E.



Descriptive notes. 60 cm; 1126 g; wingspan 114 cm. Stocky appearance with slightly barred underparts and single pale bar across short tail distinguish from *C. fasciolatus*. Individually variable in colour and barring. Juvenile brown above and on tail with white head and underparts; intermediate plumage all dark brown.

Habitat. Riverine forest, gallery forest and woodland associated with riparian systems; does not enter lowland rain forest.

Food and Feeding. Mainly snakes but also small monitor lizards, small tortoises, rodents, amphibians and some fish and insects. Perches

on open limbs among forest trees, taking most prey from the ground but some from foliage and trunks. Sedentary in small area of forest, making only short flights when changing perch.

Breeding. Laying Dec-Apr in Zambia; Mar in Zimbabwe; suspected Jan-Feb in NE Africa and Jul in NE Zaire; no breeding recorded in W Africa, but suspected breeding pair in Mar in Ghana. Vocal within forest, especially prior to nesting, and may also perform diving flight display. Builds small platform of sticks well concealed within canopy, often on a thorny tree and almost invariably among creepers. Single egg; incubation unrecorded; chick has first down white, second down fawn; fledging c. 56 days.

Movements. Usually sedentary within linear riverine forest habitats, but may move seasonally into adjacent parts of E Africa or S in wet season into Guinea woodland of W Africa.

Status and Conservation. Not globally threatened. CITES II. Locally common but with patchy linear distribution. Vulnerable to degradation of riverine habitat, e.g. in NE Namibia, where only 14 pairs now estimated to occur. Not known to be affected by pesticides.

Bibliography. Benson & Benson (1975), Brown, C.J. & Hines (1987), Brown, L.H. (1976b), Brown, L.H. *et al.* (1982), Colebrook-Robjent & Aspinwall (1986), Edwards (1985), Ginn *et al.* (1989), Gore (1990), Grimes (1987), Lewis & Pomeroy (1989), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Pickford *et al.* (1989), Pinto (1983), Steyn (1982), Thiollay (1975b, 1978c).

Genus *TERATHOPIUS* Lesson, 1830

65. Bateleur

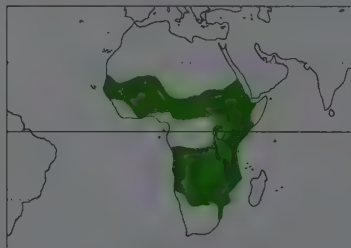
Terathopus ecaudatus

French: Bateleur des savanes **German:** Gaukler **Spanish:** Aguila Volatinera
Other common names: Bateleur Eagle

Taxonomy. *Falco ecaudatus* Daudin, 1800, Knysna district, Cape province, South Africa.

Monotypic genus. Several features of morphology, in addition to juvenile plumage and feeding habits, indicate links with *Circaetus*. Monotypic.

Distribution. Senegambia E to Sudan and Ethiopia then S to Namibia and South Africa.



Descriptive notes. 60 cm; 1820-2950 g; wingspan 187 cm. Very short tail and long primaries distinctive, especially in low rocking flight with upturned wing tips. In male, secondaries mostly black; female has secondaries grey above, mostly white below with black trailing edge; sexes separable perched and in flight, even as subadults; c. 7% of adults have back cream, not chestnut. Juvenile brown with blue-green facial skin and legs, similar to several snake-eagle plumages; becomes sooty brown with basic adult patterns in intermediate plumage, face and legs turning orange before assuming adult scarlet.

Habitat. Open woodland and tree savanna, extending into bush savanna but less into scrubby steppe and grassland.

Food and Feeding. Various small animals, taken live or as carrion. Mainly small mammals and birds, also reptiles, fish, birds' eggs, crabs and insects. Hunts from characteristic low searching flight, gliding back and forth about 50 m above ground. Usually descends on prey in tight spiral. Up to 50 may gather at emergences of termite alates, especially immatures.

Breeding. Laying Sept-Dec in W Africa; all months in E Africa (peak Feb-Mar) and S Africa (peak Dec-Mar). Performs acrobatic rocking display flight. Builds large nest of sticks in open fork of large tree, sometimes on old structure of another bird species, often along a watercourse. Single egg; incubation 52-59 days; chick's down dark brown, with cream head and thighs; fledging extremely variable at 93-194 days; post-fledging dependence of up to 4 months; parents share rearing of young and extra juvenile or adult may attend some nests.

Movements. Adult pairs territorial and resident in most areas, but juveniles excluded, becoming highly mobile and nomadic, with concentrations developing in some areas such as SW and E Africa. May move N in rainy season in W Africa during Jul-Sept. Vagrant to Tunisia, Israel, SW Arabian Peninsula and Iraq.

Status and Conservation. Not globally threatened. CITES II. Widespread and common at densities of 1 pair/140-200 km² in Kenya, or 1 pair/30-60 km² in Transvaal (estimated total of 600 pairs). Suffered extensive range retraction in many areas of South Africa, Namibia and Zimbabwe through poisoning and nest disturbance, and now only common in larger nature reserves. Also declining in W Africa (Ivory Coast) and in Sudan. Some evidence for pesticide contamination in S Africa but no population effects described.

Bibliography. Benson & Benson (1975), Britton (1980), Brown, L.H. (1955), Brown & Cade (1972), Brown *et al.* (1982), Colebrook-Robjent & Aspinwall (1986), Cramp & Simmons (1980), Ginn *et al.* (1989), Gore (1990), Grimes (1987), Herholdt & de Villiers (1989, 1991), Hustler (1985), de Kock & Watson (1985), Lewis & Pomeroy (1989), Mackworth-Praed & Grant (1962), Maclean (1993), Moreau (1945), Nikolaus (1987), Orosion (1993), Pap (1987), Smock (1973), Snelling (1970), Snelling *et al.* (1984), Steyn (1965a, 1980b, 1982), Turboton & Allan (1984), Thiollay (1978c, 1985d), Tree (1978), Watson (1985, 1987, 1988, 1989, 1990a, 1990b), Wilson, R.T. (1982).

Genus *SPILORNIS* G. R. Gray, 1840

66. Crested Serpent-eagle

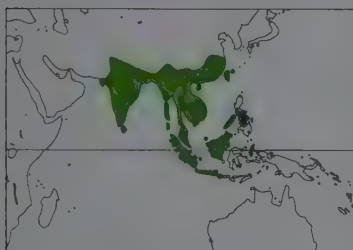
Spilornis cheela

French: Serpenteaire bacha **German:** Schlangenweihe **Spanish:** Culebrera Chifla
Other common names: Small/Nicobar (Crested) Serpent-eagle (*minimus*); Ryukyu Serpent-eagle (*perplexus*); Simeulue Serpent-eagle (*abbotti*); Nias Serpent-eagle (*asturinus*); Mentawai Serpent-eagle (*sipora*); Natuna Serpent-eagle (*naturensis*)

Taxonomy. *Falco Cheela* Latham, 1790, India = Lucknow. Complex genus, with taxonomy extremely confused and tentative; complete revision and extensive study of relationships and species limits required; research priorities include field work on biology, especially with regard to prey and vocalizations, and laboratory analyses of DNA. Present species currently considered to form superspecies with *S. klossi*, *S. kinabaluensis*, *S. rufipectus* and *S. holospilus*, but may be conspecific with any or all of these taxa; any or all of races *perplexus*, *abbotti*, *asturinus*, *sipora* and *naturensis* may be valid species; different treatment of these two groups is essentially arbitrary in most cases; extraordinary size differences suggest that some island races probably merit recognition as full species. Situation in Nicobar Is particularly complicated and uncertain, although presence of two different species of *Spilornis* generally agreed upon: race *davisoni* said to occur by some authors; race *minimus* often considered separate species, usually including *S. klossi*. Several further races have been described. Twenty-one subspecies currently recognized.

Subspecies and Distribution.

- S. c. cheela* (Latham, 1790) - N India and Nepal.
- S. c. melanotis* (Jerdon, 1844) - India S from Gujarat and Gangetic Plain.
- S. c. spilogaster* (Blyth, 1852) - Sri Lanka.
- S. c. burmanicus* Swann, 1920 - Burma, SW China, Thailand and Indochina.
- S. c. davisoni* Hume, 1873 - Andaman Is; possibly also Nicobar Is.
- S. c. minimus* Hume, 1873 - C Nicobar Is.
- S. c. ricketti* W. L. Slater, 1919 - N Vietnam and SC & SE China.
- S. c. perplexus* Swann, 1922 - S Ryukyu Is.
- S. c. hoyi* Swinhoe, 1866 - Taiwan.
- S. c. rutherfordi* Swinhoe, 1870 - Hainan.
- S. c. palawanensis* W. L. Slater, 1919 - Palawan group (Philippines).
- S. c. pallidus* Walden, 1872 - lowlands of N Borneo.
- S. c. richmondi* Swann, 1922 - S Borneo.
- S. c. naturensis* Chasen, 1934 - Natuna Is and Belitang I (off W & SW Borneo).
- S. c. malayensis* Swann, 1920 - Malay Peninsula (from S Tenasserim), nearby Anambas Is and N Sumatra.
- S. c. batu* Meyer de Schauensee & Ripley, 1939 - S Sumatra and Batu Is (off W Sumatra).
- S. c. abbotti* Richmond, 1903 - Simeulue I (off W Sumatra).
- S. c. asturinus* A. B. Meyer, 1884 - Nias I (off W Sumatra).
- S. c. sipora* Chasen & Kloss, 1926 - Mentawai Is (off W Sumatra).
- S. c. bido* (Horsfield, 1821) - Java and Bali.
- S. c. haweanus* Oberholser, 1917 - Bawean I (off N Java).



Habitat. Occurs in a wide variety of habitats, including dry to wet forests, tea plantations, wooded savannas and mangroves. Frequents open or closed forest, but not in dense forest interior; only secondary or partly open forest, clearings, gaps and forest edge; also plantations, e.g. of teak. Occurs from sea-level to 1900 m.

Food and Feeding. Preys mainly on reptiles, especially tree snakes; also a few mammals, crabs, eels and birds. Hunts almost exclusively from exposed perch near open glade, along stream or along forest edge. Snakes taken on ground or in trees, after short stoop. Much time spent soaring, and individuals soar and call throughout year.

Breeding. Season varies with locality, depending on timing of rainy season (laying mostly in dry season in N of range): Dec-Mar in S India; Feb-May in N India, and also in Sri Lanka; Feb-Apr in Burma and Sumatra; record of second brood in Jun in Burma. Rather small nest lined with grass, built by pair 7-12 m up large tree; often near clearing or stream. Spectacular display flights include mutual soaring, undulations and threat display, with wings bowed upwards and head and tail raised; also accompanied by loud vocalizations. 1 egg (reports of 2 eggs should be verified); incubation c. 35+ days, by female; chick has white down; both parents feed chick; fledging and dependency periods unknown. A fledgling being fed in Sept in Malaysia may indicate late nesting or long dependency period.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES II. Throughout extensive range generally widespread and common, sometimes abundant, but locally uncommon. No threats known at present, and species appears to be quite adaptable to disturbed habitats. Surveys required, in order to establish conservation status of well marked island races, especially as some (or all) of these may subsequently prove to be distinct species.

Bibliography. Ali & Ripley (1978), Amadon (1964, 1974), Brazil (1991), Brown, L.H. (1976b), Cheng Tso-hin (1987), Deignan (1945, 1963), Dickinson *et al.* (1991), Etchécopar & Hue (1978), Henry (1971), Inskipp & Inskipp (1985), King *et al.* (1975), Lekagul & Round (1991), MacKinnon (1988), MacKinnon & Philipps (1993), van Marle & Vooijs (1988), Medway & Wells (1976), Meyer de Schauensee (1984), Naoraji (1985), Naoraji & Monga (1983), Parkes (1973), Rand & Rabot (1960), Roberts (1991), Severinghaus & Blackshaw (1976), Smythies (1981, 1986), Thiollay & Meyburg (1988), Tikader (1988), Wilkinson *et al.* (1991a, 1991b).

67. Great Nicobar Serpent-eagle

Spilornis klossi

French: Serpenteaire menu **German:** Kloss-Schlangenweihe **Spanish:** Culebrera de Nicobar
Other common names: (Great) Nicobar (Crested) Serpent-eagle

Taxonomy. *Spilornis klossi* Richmond, 1902, Great Nicobar Island. Taxonomic status uncertain, although existence of two species of *Spilornis* in Nicobar Is generally agreed upon: present species sometimes considered conspecific with *S. cheela*; *S. (cheela) minimus* often awarded full species status, in which case usually considered to include *S. klossi* as race. Currently considered to form superspecies with *S. cheela*, *S. kinabaluensis*, *S. rufipectus* and *S. holospilus*. Monotypic.

Distribution. Great Nicobar I (Nicobar Is).



Descriptive notes. 38-41 cm. Small, secretive, but confiding serpent-eagle; pale, uniformly coloured underparts; in contrast to *S. cheela* (in its various forms), tail presents several much narrower bands. Juvenile has broad buffy edging on feathers of crown, back and upperwing- and upper-tail-coverts; subadult has brownish grey iris.

Habitat. Apparently found mainly, or exclusively, in interior of rain forest.

Food and Feeding. Little studied; lizards, rats, Emerald Dove (*Chalcophaps indica*) and small birds recorded. Habits presumably similar to congeners.

Breeding. No information available. Apparently no display flight, as species was not seen flying during recent raptor survey in period Mar-Apr, when species is thought to be breeding.

Movements. Apparently sedentary.

Status and Conservation. Not globally threatened. CITES II. Seen only twice during recent raptor survey, on both occasions perched inside forest. Reported by one source to be common. More than 80% of island still covered with undisturbed primary forest; two new national parks proposed, covering 536 km² of island. Intensive survey work required to determine status; general research also needed.

Bibliography. Ali & Ripley (1978), Amadon (1964, 1974), Amadon & Bull (1988), Brown & Amadon (1968), Richmond (1903), Tikader (1988).

68. Kinabalu Serpent-eagle

Spilornis kinabaluensis

French: Serpenteaire de Kinabalu **German:** Bergschlangenweihe **Spanish:** Culebrera del Kinabalu

Other common names: Mountain Serpent Eagle

Taxonomy. *Spilornis cheela kinabaluensis* W. L. Slater, 1919, Mount Kinabalu, north Borneo. Taxonomic status uncertain: sometimes regarded as race of *S. cheela*, but apparently does not intergrade with sympatric *S. cheela pallidus*; also altitudinally segregated and vocalizations quite different. Present species currently considered to form superspecies with *S. cheela*, *S. klossi*, *S. rufipectus* and *S. holospilus*. Monotypic.

Distribution. Mountains of N Borneo, recorded on Mt Mulu (NE Sarawak), Mt Murud (NE Kalimantan) and Mt Kinabalu (W Sabah).



Descriptive notes. c. 51-55 cm. Large, dark serpent-eagle; differs from *S. cheela* in darker overall coloration, longer wings and markedly different vocalizations. Larger and darker than sympatric *S. cheela pallidus*. Juvenile presumably similar to that of *S. cheela*.

Habitat. Montane forests; occupies higher altitudes than sympatric *S. cheela pallidus*, which inhabits adjacent lowlands.

Food and Feeding. Particularly snakes and lizards; generally similar to *S. cheela*.

Breeding. No information available.

Movements. Apparently sedentary.

Status and Conservation. RARE. CITES

II. Status very poorly known. May be threatened in long term by clear-felling of forests. Surveys required to determine conservation status; research on biology also highly desirable.

Bibliography. Amadon (1964, 1974), Brown & Amadon (1968), Collar & Andrew (1988), MacKinnon & Philipps (1993), Smythies (1981).

69. Sulawesi Serpent-eagle

Spilornis rufipectus

French: Serpenteaire des Célèbes **German:** Celebesschlangenweihe **Spanish:** Culebrera de Célebes

Other common names: Celebes Serpent-eagle

Taxonomy. *Spilornis rufipectus* Gould, 1858, vicinity of Macassar, Sulawesi. Taxonomic status uncertain: sometimes considered conspecific with *S. cheela*. Currently considered to form superspecies with *S. cheela*, *S. klossi*, *S. kinabaluensis* and *S. holospilus*. Race *sulaensis* poorly differentiated, and perhaps of questionable validity. Two subspecies normally recognized.

Subspecies and Distribution. *S. r. rufipectus* Gould, 1858 - Sulawesi, and islands of Salayar, Muna and Butung, off S Sulawesi. *S. r. sulaensis* (Schlegel, 1866) - Banggai and Sula Is, off E Sulawesi.

Descriptive notes. 41-50 cm. Medium-sized serpent-eagle; similar to *S. cheela*, especially in being vocal and conspicuous, but has completely dark hood, with barred belly and flanks, and rather narrow pale bar in tail. Race *sulaensis* generally smaller and paler than nominate, with bolder barring on underparts.

Habitat. Forest edge and openings, secondary forest and grassy savannas, from 300 to 1000 m.

Food and Feeding. Virtually nothing known; diet and habits most likely similar to *S. cheela*. Readily attracted to grass fires; often forages over open grassland.



Ruiter (1947), Stresmann (1940a), White & Bruce (1986).

70. Philippine Serpent-eagle

Spilornis holospilus

French: Serpente des Philippines

German: Philippinenschlangenweihe

Spanish: Culebrera Filipina

Taxonomy. *Buteo holospilus* Vigors, 1831, near Manila.

Taxonomic status uncertain: sometimes classified as race of *S. cheela*; shares Philippines with *S. cheela palawanensis*, but without sympatry. Currently considered to form superspecies with *S. cheela*, *S. klossi*, *S. kinabaluensis* and *S. rufipectus*. Proposed race *panayensis* not valid. Monotypic.

Distribution. N & E Philippine Is, from Luzon S to Mindanao.



Descriptive notes. c. 47-5-64 cm; 604-762 g (2 birds). Medium-sized serpent-eagle, with relatively longer tail than most congeners; similar to *S. cheela*, but has underparts uniformly coloured, with markings generally more clearly defined; lacks dark crown. Juvenile similar to juvenile *S. cheela*. Purported race *panayensis* said to be smaller and paler, but differences might be due to individual variation.

Habitat. Forests and forest edge; also in open country.

Food and Feeding. Observed feeding on snake. No further information available; diet

and habits presumably similar to those of *S. cheela*.

Breeding. Female with egg in oviduct collected in Apr. No further information available.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES II. Fairly common. Apparent adaptability to open and secondary habitats suggests species not seriously threatened despite rampant deforestation throughout much of limited range.

Bibliography. Amadon (1964, 1974), Brown, L.H. (1976b), Brown & Amadon (1968), Dickinson *et al.* (1991), Gilliard (1950), McGregor (1909-1910), Rand & Rabor (1960).

71. Andaman Serpent-eagle

Spilornis elgini

French: Serpente des Andaman

German: Andamanenschlangenweihe

Spanish: Culebrera de Andamán

Other common names: Andaman Dark Serpent Eagle

Taxonomy. *Haematornis elgini* Blyth, 1863, South Andaman Island.

The only taxon in the *Spilornis* complex that is definitely separate species and not race of *S. cheela*, as occurs in sympatry with *S. cheela davisoni*. Monotypic.

Distribution. Andaman Is.



Descriptive notes. 49-54 cm; 790-1000 g; wingspan 115-123 cm. Medium-sized dark serpent-eagle. Overall, very dark brown with numerous small white spots. Vocalizations consist of clear whistles, differing markedly from calls of *S. cheela*. Juvenile similarly dark overall, but with paler head.

Habitat. Forest, typically in clearings; also on open hillsides with scattered trees. Traditionally said to be ecologically segregated from sympatric *S. cheela davisoni*, which has been claimed to stick mainly to coastal forest, especially tidal creeks and mangrove swamps, while present species normally occurs inland;

however, both species occur and even display near each other in inland areas, although present species is more numerous.

Food and Feeding. Apparently takes variety of prey, especially birds; also frogs, lizards, rats and snakes. Hunts from perch in typical style of genus.

Breeding. Quite vocal during display flights, which include mutual soaring over territory. No further information available.

Movements. Sedentary.

Status and Conservation. RARE CITES II. Common, sometimes reaching surprisingly high densities; most numerous raptor on Andaman Is. Probably should not be classed as threatened, but rapidly growing human population may encroach on forest habitat in future.

Bibliography. Ali & Ripley (1978), Amadon (1964, 1974), Brown, L.H. (1976b), Brown & Amadon (1968), Butler (1899), Collar & Andrew (1988), Ripley (1982), Tikader (1988).

Genus *DRYOTRIORCHIS* Shelley, 1874

72. Congo Serpent-eagle

Dryotriorchis spectabilis

French: Serpente du Congo

German: Schlangenbussard

Spanish: Culebrera Congoleña

Other common names: African Serpent-eagle

Taxonomy. *Astur spectabilis* Schlegel, 1863, St George Elmina, Ghana.

Monotypic genus, may be most related to Asian *Spilornis* species and Madagascan *Eutriorchis*. Two subspecies recognized.

Subspecies and Distribution.

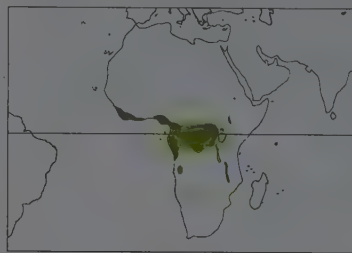
D. s. spectabilis (Schlegel, 1863) - Sierra Leone E to S Nigeria and NW Cameroon.

D. s. batesi Sharpe, 1904 - S Cameroon E to W Uganda and S to Gabon and SC Zaire; N Angola.

Descriptive notes. 50 cm. Short, rounded wings and long, rounded tail distinctive. Eye yellow in adult male, brown in female. Juvenile similar to adult but for pale head and neck; heavily spotted underparts similar to juveniles of African forest *Accipiter* and *Aviceda* species; separate morph or intermediate plumage with fine black streaks below. Race *batesi* browner, and much less spotted and marked below.

Habitat. Lowland tropical rain forest.

Food and Feeding. Mainly reptiles, especially snakes (with their prey), chameleons and lizards, and some toads. Hunts from a perch, dropping down to take prey from foliage or the ground



below, sometimes striking repeatedly at prey with the feet almost like a Secretarybird (*Sagittarius serpentarius*). Mainly within forest understorey, to which its large eyes appear well suited.

Breeding. Unrecorded. Indications of breeding Oct-Dec in Gabon, sometime during period Jun-Nov in Zaire. Regularly utters loud crowing calls.

Movements. No movements recorded.

Status and Conservation. Not globally threatened. CITES II. Appears to be rather common in many larger tracts of forest, judging from calls, but inconspicuous except for persistent calling. Vulnerable to deforestation, due to intolerance of secondary habitats, which now dominate much of its range in W Africa. Not known to be affected by pesticides.

Bibliography. Brosset & Erard (1986), Brown *et al.* (1982), Chapin (1932), Ferguson-Lees & Faull (1992), Gatter (1988), Grimes (1987), Lippens & Wille (1976), Louette (1981), Mackworth-Praed & Grant (1957-1973), Pinio (1983), Rodewald *et al.* (1994), Serle *et al.* (1977), Snow (1978), Thiollay (1975a, 1978c).

Genus *EUTRIORCHIS* Sharpe, 1875

73. Madagascar Serpent-eagle

Eutriorchis astur

French: Serpente de Madagascar

German: Schlangenhacht

Spanish: Culebrera Azor

Other common names: Long-tailed Serpent-eagle

Taxonomy. *Eutriorchis astur* Sharpe, 1875, southern Madagascar.

Monotypic genus, most similar to monotypic African *Dryotriorchis*. Monotypic.

Distribution. Madagascar, originally along all moist eastern regions, but now confined to NE.

Descriptive notes. 66 cm. Upperparts and underparts clearly barred, wing feathers and long tail distinctively banded. Voluminous crest and yellow eye and legs notable; said to erect crest when excited. Juvenile with white edging to feathers giving scaly effect dorsally. Closely resembles sympatric *Accipiter henstii* in size and colour, but breast more broadly barred and latter has white eyebrow.

Habitat. Primary rain forest up to 1000 m; also around ecotone with secondary forest.

Food and Feeding. Large chameleon found in stomach of collected specimen; also reported to eat lemurs and poultry. Descends to forest floor, or flies from branch to branch within forest.

Breeding. Unrecorded.

Movements. None recorded.

Status and Conservation. ENDANGERED. CITES II. Species not recorded by scientists between 1935, when two specimens were collected, and 1988, although 5 possible sightings were made by foresters over the period 1964-1977. Only known previously from 11 museum specimens collected between 1875 and 1935 from 4 main areas, of which 3 remain more or less intact. Recently sighted and even trapped alive; projects currently being run in Madagascar by WWF and Peregrine Fund should help to ascertain conservation status of species and also promote environmental awareness. Its future depends on preservation of adequate rain forest in NE of the island, especially the Marojejy, Masaola, Ambutovaky, Zhamane and Mantady tracts, and possibly also the Mangoro Valley tract.

Bibliography. Benson *et al.* (1976), Collar & Andrew (1988), Collar & Stuart (1985), Dee (1986), Eek (1986), Jackson (1987), King (1978/79), Langrand (1990), Lavauden (1932, 1937), McNulty (1975), Meyburg (1979b, 1984), Milton *et al.* (1973), Rand (1936), Raxworthy & Culston (1992), Sheldon & Duckworth (1990), Shuker (1993).

Genus *CIRCUS* Lacépède, 1799

74. Western Marsh-harrier

Circus aeruginosus

French: Busard des roseaux **German:** Rohrweihe **Spanish:** Aguilucho Lagunero Occidental
Other common names: Eurasian Marsh-harrier, Marsh Harrier

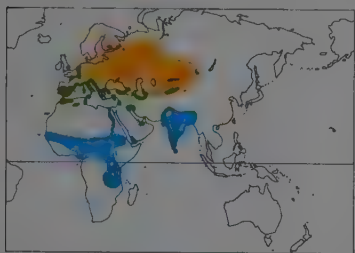
Taxonomy. *Falco aeruginosus* Linnaeus, 1758, Sweden.

Forms superspecies with *C. ranivorus*, *C. spilonotus*, *C. approximans* and *C. maillardi*, all of which have frequently been lumped within present species. Two subspecies currently recognized.

Subspecies and Distribution.

C. a. aeruginosus (Linnaeus, 1758) - Europe and Asia Minor E into C Asia, E to upper R Yenisey and Mongolia; winters in W & S Europe, Africa S of Sahara, and in Indian Subcontinent and Sri Lanka.

C. a. harterti Zedlitz, 1914 - NW Africa, from Morocco to Tunisia.



Descriptive notes. 48-56 cm; male 405-667 g, female 540-800 g; wingspan 110-130 cm. Plumage rather variable. Male generally brown above, particularly on back; underparts streaked, but solid dark brown at least on belly and vent; plumage becomes progressively paler with age. Female averages larger; usually brown with yellowish cream crown, throat and forewing. All dark or melanistic morph in some adults. Juvenile similar to female, but lacks pale shoulder; often all dark chocolate. Race *harterti* has much paler underparts than nominate.

Habitat. Typically in extensive areas of dense marsh vegetation, especially reeds and reedmace, in aquatic habitats of both fresh and brackish water, e.g. marshes, swamps, lagoons, etc.; sometimes in areas lacking stretches of open water. Also in other aquatic habitats, e.g. lakes, reservoirs and rivers typically with reedbeds along margins. Sometimes in other open areas, normally in or near wetlands, e.g. grassland and other low vegetation, salt-pans, paddyfields and other cereal fields. Generally in lowland plains, although up to 2000 m in Asia. On migration and in winter quarters, can occur in less typical habitats, e.g. over forest and mountains above 3000 m in W Cameroon. On occasions, hundreds of birds gather in roosts, mainly in reedbeds.

Food and Feeding. Great opportunist, lacks specialization; very wide range of prey, varying with local availability. Prefers small or medium-sized birds, and often their chicks and eggs; also mammals, especially rodents and rabbits; to much lesser extent, fish, reptiles (e.g. lizards, snakes), frogs and some invertebrates. Birds taken are mainly aquatic, e.g. ducks, rails and waders, and marsh passerines; larger birds tend to be those that are vulnerable, e.g. ducks that are wounded or in eclipse. Also takes carrion, especially in winter, from small animals to cetaceans and large herbivores. In C Europe, voles can dominate in diet, during years of plenty; in C & S Spain, rabbits and rats important. Characteristic low, buoyant flight over marshy vegetation; attempts to surprise prey, diving on it on ground or water.

Breeding. Laying mainly in Apr-May, till Jun in N Europe. Generally monogamous, but males sometimes polygynous. Solitary or in small, loose colonies; almost always in dense marsh vegetation, such as reedbeds. If pair-bond is maintained, pair tends to nest near previous year's site. Nest is pile of reeds, reedmace and rushes, c. 60-80 cm wide and of variable depth (deeper if base touches water); built by female, but both adults add material throughout breeding. Normally 3-6 eggs (2-7), at intervals of 1-2 days; replacement laying can occur; incubation 31-38 days per egg, by female; both adults hunt for chicks (at first just male); fledging c. 35-40 days; young remain with adults 2-3 weeks more. Sexual maturity at 2-3 years. Rate of hatching failure varies, but can be very high: normally 2-4 chicks fledge (up to 5), mean 1.8-3.2 per breeding pair, and 2-7-3.5 per successful pair. Oldest recorded bird 16 years.

Movements. Mainly migratory in N & E Europe and C Asia; sedentary and dispersive in S of breeding range. N breeders winter from France and N Africa through Mediterranean to Turkey, Middle East and Nile Valley, and S to sub-Saharan Africa; easternmost Asian populations winter in Indian Subcontinent and Sri Lanka; also said to winter in SE China and Greater Sundas, but considerable confusion in this zone with *C. spilonotus*. Migrants start to arrive on breeding grounds in Mar, or Apr in N of range; leave mainly in Sept-Oct, although juveniles start dispersal earlier.

Status and Conservation. Not globally threatened. CITES II. Population trends have varied in Europe throughout 20th century, but overall decline in numbers and range; from 1980's, generalized recovery, with populations of N & C Europe increasing, and to lesser degree those of S Europe. In 1980's, possibly c. 10,000 pairs in Europe (excluding former USSR, where species also on increase); largest populations in Germany with 2225-2350 pairs, Poland 1500-2000 pairs, Hungary over 1000 pairs, France 700-1000 pairs, Netherlands 800-900 pairs, Czechoslovakia 600 pairs, Sweden 520 pairs, Denmark 500 pairs and Spain 480-520 pairs. In early 1990's estimates of 30,000 pairs in European Russia, 2200-3000 pairs in Byelorussia, and over 150 pairs in Azerbaijan. In 1980's, estimates of 100's of pairs in Morocco (*harterti*), and perhaps 100-250 pairs in Turkey. Main factors in decline, most of which continue to affect species, include: drying out of wetlands; direct persecution, especially shooting; poisoning by pesticides applied liberally in wetlands and nearby crop fields; contamination by lead shot consumed from wounded waterbirds; and more generalized poisoning by heavy metals.

Bibliography. Ali & Ripley (1978), Altenburg *et al.* (1982), Bavoux *et al.* (1992), Benson (1960a), Bergier (1987), Blanco, G. *et al.* (1993), Boek (1976, 1978), Brown *et al.* (1982), Clarke *et al.* (1993), Clouet (1978), Cramp & Simmons (1980), Dementiev & Gladkov (1951), Divi (1984), Elchécopar & Hue (1978), Flint *et al.* (1984), Gensbol (1986), Giraud-Audine & Pinaud (1974), González, J.L. (1991), Handruss & Demetriopoulos (1983), Hilden & Kallinainen (1966), Ilyinsky *et al.* (1990), Jørgensen *et al.* (1982), Kjellen (1992), Konradt (1966), Lever (1987), Lasis (1961), Mackworth-Præd & Grant (1957 1973), Marchant *et al.* (1990), Martin, B.P. (1992), Missbach (1972), Nieboer (1973), Pain *et al.* (1993), Paz (1987), Pinowski (1961), Pinto (1983), Richardson (1990), Roberts (1991), Rogacheva (1992), Schipper (1977, 1978), Schipper *et al.* (1975), Shirihai & Christie (1992), Simeonov *et al.* (1990), Simmons (1988, 1991a), Thiollay (1970, 1989), Underhill-Day (1984), Witkowski (1989).

75. African Marsh-harrier

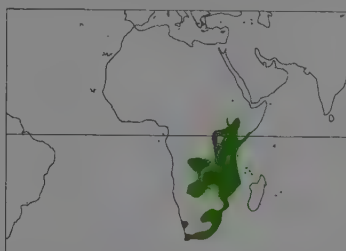
Circus ranivorus

French: Busard grenouillard **German:** Froschweihe **Spanish:** Aguilucho Lagunero Etiópico

Taxonomy. *Falco ranivorus* Daudin, 1800, South Africa.

Forms superspecies with *C. aeruginosus*, *C. maillardi*, *C. spilonotus* and *C. approximans*; sometimes all considered conspecific, but present species differs from closest ally, *C. aeruginosus*, in some aspects of plumage and morphology, probably in breeding behaviour and display, and in lack of pronounced sexual dimorphism in plumage. Birds of E & C Africa sometimes placed in separate race, *aequatorialis*, on grounds of smaller size, but validity very doubtful. Monotypic.

Distribution. Zaire, Uganda and Kenya S to South Africa; ranges NE to Ethiopia and Somalia.



Descriptive notes. 44-49 cm; 382-590 g. Individually variable. Female larger and often darker above and more rufous below than male. Separable from *C. aeruginosus*, in which male has plain grey areas in wing and tail, while female has pale crown and forewing. Juvenile of present species darker brown than adults, with plain underparts and usually pale band across breast.

Habitat. Marshes and adjacent grassland and cropland.

Food and Feeding. Small rodents and birds, up to size of 600 g teal (*Anas*); also nestlings, eggs, frogs, insects and some carrion. Hunts

upwind with low, slow coursing flight, checking and hovering before a swift turn onto prey, alternating with fast sweeps downward to surprise and snatch up prey in flight, especially birds.

Breeding. Laying mainly in dry season: Jun-Jul in Kenya; all months in S Africa (peak Jun-Nov in Cape winter-rainfall zone, Dec-Jun in summer-rainfall areas). Distinctive sky-dancing courtship display. Builds nest platform of weeds and reeds lined with dry grass; scanty when built on ground, grass or sedges in small marsh, but deeper when among reeds and rushes over open water. Usually 3-4 eggs (3-6); incubation 31-34 days; chicks have white down; fledging 38-41 days.

Movements. No regular movements described. Resident around perennial water bodies; nomadic to ephemeral wetlands, with considerable local dispersal, especially of juveniles.

Status and Conservation. Not globally threatened. CITES II. Common on major wetlands of E and S Africa, especially in Botswana, Zambia and Uganda. 500-1000 pairs in Transvaal, South Africa. Vulnerable to drainage, burning and grazing of more seasonal wetlands, where generally local or uncommon, and declining, in most parts of E and S Africa. Slightly contaminated but not obviously affected by pesticides.

Bibliography. Benson & Benson (1975), Britton (1980), Brown *et al.* (1982), Ginn *et al.* (1989), Kemp & Dean (1988), de Kock & Simmons (1988), Lewis & Pomeroy (1989), Mackworth-Præd & Grant (1957, 1962), Maclean (1993), Malherbe (1970), Nichol (1963), Pickford *et al.* (1989), Pinto (1983), Simmons (1990, 1991a, 1991d, 1992a), Snow (1978), Steyn (1982), Tarboton & Allan (1984).

76. Eastern Marsh-harrier

Circus spilonotus

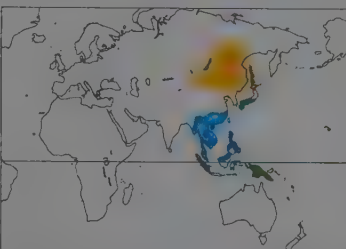
French: Busard d'Orient **German:** Mangroveweihe **Spanish:** Aguilucho Lagunero Oriental
Other common names: Spotted Marsh-harrier; Spotted-backed/Papuan Harrier (*spilothorax*)

Taxonomy. *Circus spilonotus* Kaup, 1847, Asia.

Often considered a race of *C. aeruginosus*, with which it forms superspecies, along with *C. ranivorus*, *C. approximans* and *C. maillardi*. Race *spilothorax* possibly approaching species level. Two subspecies normally recognized.

Subspecies and Distribution.

C. s. spilonotus Kaup, 1847 - SE Siberia and Mongolia to Ussuriland, Sakhalin, NE China and N Japan; winters from S Japan and SE Asia and S China to Indonesia and Philippines.
C. s. spilothorax Salvadori & D'Alberty, 1875 - C & E New Guinea.



Descriptive notes. 47-55 cm; 370-780 g. Male similar to that of *C. aeruginosus*, but paler and more finely streaked. Female differs from that of *C. aeruginosus* in dark streaking on crown and nape. Immature said to be darker than that of *C. aeruginosus*. Race *spilothorax* polymorphic; normal morph usually has heavier streaking on head and neck, but birds from Central Highlands of New Guinea have solid blackish throat; dark morph mostly blackish with some pale streaking, pale primary windows and grey tail.

Habitat. Marshes, swamps, lake edges, and especially large reedbeds; also other open

areas, e.g. paddyfields and grassland, particularly outside breeding season. In New Guinea, mainly in highlands.

Food and Feeding. Opportunist hunter, like *C. aeruginosus*; captures disabled aquatic birds, or those caught unawares; takes small terrestrial passerines, nestlings and eggs; sometimes rodents, e.g. voles, ground squirrels, mice, although normally to lesser degree; also frogs and fish. Forages in typical manner of harriers, floating low over open habitats, attempting to surprise prey.

Breeding. Laying from mid-May to early Jun. Nests on ground in marshes, mainly in reedbeds. Nest is fairly large; built of reeds and sticks, without any special lining. Lays 3-7 eggs, at intervals of 3-3 days; incubation 33-48 days; fledging 35-40 days. Low hatching success in Hokkaido (Japan). Sexually mature probably at 2-3 years old.

Movements. Mostly migratory; apparently sedentary in New Guinea. Populations from SE Siberia, Mongolia and NE China winter from Burma to S China and S to Malay Peninsula, Indochina, Sumatra, N Borneo and Philippines; in Japan, winters in C & S Honshu and Kyushu. Reaches breeding areas during Apr and early May; leaves mainly Sept-Oct.

On following pages: 77. Pacific Marsh-harrier (*Circus approximans*); 78. Madagascar Marsh-harrier (*Circus maillardi*); 79. Long-winged Harrier (*Circus buffoni*); 80. Spotted Harrier (*Circus assimilis*); 81. Black Harrier (*Circus maurus*); 82. Hen Harrier (*Circus cyaneus*); 83. Cinereous Harrier (*Circus cinereus*); 84. Pallid Harrier (*Circus macrourus*); 85. Pied Harrier (*Circus melanoleucos*); 86. Montagu's Harrier (*Circus pygargus*).

Status and Conservation. Not globally threatened. CITES II. Very little information available about population sizes and trends. Generally rare and patchily distributed in former USSR; uncommon breeder in N Japan. Presumably affected by degradation of wetlands throughout much of extensive range.

Bibliography. Ali & Ripley (1978), Austin (1948), Austin & Kuroda (1953), Beehler (1978), Brazil (1991), Brazil & Hanawa (1991), Cheng Tso-hin (1987), Clarke (1993), Coates (1985), Deignan (1945), Dickinson *et al.* (1991), Eichécopar & Hue (1978), Lekagul & Round (1991), Lever (1987), Mackay (1991), MacKinnon & Phillips (1993), van Marle & Vocus (1988), Medway & Wells (1976), Nishide (1979), Peckover & Filewood (1976), Ripley (1982), Smythies (1981, 1986).

77. Pacific Marsh-harrier

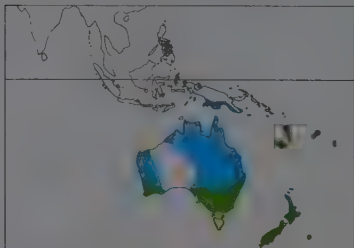
Circus approximans

French: Busard de Gould **German:** Sumpfweihe **Spanish:** Aguilucho Lagunero del Pacífico
Other common names: Australasian/Swamp Harrier

Taxonomy. *Circus approximans* Peale, 1848, Vanua Levu, Fiji.

Has been considered a race of *C. aeruginosus*, with which it forms superspecies, along with *C. ranivorus*, *C. spilonotus* and *C. maillardi*; separated by plumage. Supposedly larger race *gouldi* of New Guinea, Australia and New Zealand shown by recent work not to differ. Monotypic.

Distribution. S New Guinea (breeding uncertain), Melanesia, Australia, New Zealand and Polynesia E to Tonga. Introduced to Society Is.



Descriptive notes. 50-61 cm; male 392-726 g, larger female 622-1080 g; wingspan 121-142 cm. A typical marsh-harrier, duller than *C. aeruginosus*. Female darker and browner, and more rufous ventrally. Juvenile solid dark brown, with trace of pale rump. Adult greyer, juvenile darker and browner than juvenile *C. assimilis*.

Habitat. Terrestrial, estuarine and coastal wetlands, grasslands, crops and pasture, from sea-level up to 1700 m. Nests in tall reeds, grass, crops and other dense ground cover.

Food and Feeding. Mammals, birds and eggs, reptiles, amphibians, fish, insects and carrion.

Forages by low, slow quartering; also by soaring. Seizes prey by diving or dropping to ground or water surface; harries aquatic birds to exhaustion or sometimes drowns them. Robs other raptors. **Breeding.** Sept-Dec. Solitary; rarely polygynous. Nest is a platform of sticks, reeds, grass and other plants on ground or over water among tall grass, reeds or shrubs. Usually 3-4 eggs (2-7); incubation 31-34 days; chicks have white down; fledging c. 43-46 days; post-fledging dependence 4-6 weeks. Oldest ringed bird 18 years. Success 1.05-1.75 young fledged per nest, 1.82-2.15 per successful nest.

Movements. Migratory in S; resident at lower latitudes where numbers swelled by wintering birds. Winter migrants reach N Australia and New Guinea.

Status and Conservation. Not globally threatened. CITES II. Common in suitable habitat, but local declines where wetlands drained. Nests vulnerable to human disturbance. Eggshell thickness significantly reduced by DDT use (now ceased) in S agricultural areas of Australia. Sometimes shot.

Bibliography. Baker-Gabb (1978, 1979, 1981a, 1981b, 1982a, 1982b, 1983, 1984a, 1985b, 1986, 1993), Baker-Gabb & Fitzherbert (1989), Beehler *et al.* (1986), Bregulla (1992), Coates (1985), Copper & Copper (1981), Gurr (1968), Hedley (1976), Hollands (1984), Holyoak & Thibault (1984), Mackay (1991), Marchant & Higgins (1993), Newgrain *et al.* (1993b), Olsen & Marples (1993), Olsen, Crome & Olsen (1993), Olsen, Fuller & Marples (1993), Pierce & Maloney (1989), Schodde & Tidemann (1988), Tollan (1988).

78. Madagascar Marsh-harrier

Circus maillardi

French: Busard de Maillard **Spanish:** Aguilucho Lagunero Malgache

German: Madagaskarweihe

Other common names: Madagascar Harrier, Malagasy Marsh-harrier; Reunion Marsh-harrier/Harrier (*maillardi*)

Taxonomy. *Circus Maillardi* J. Verreaux, 1862, Reunion.

Forms superspecies with *C. aeruginosus*, *C. ranivorus*, *C. approximans* and Asian *C. spilonotus*; most closely linked with last. Two subspecies recognized.

Subspecies and Distribution.

C. m. maillardi J. Verreaux, 1862 - Reunion I.

C. m. macroseles Newton, 1863 - Madagascar and Comoro Is.



Descriptive notes. 54-59 cm. White underparts, streaked with black, and grey secondaries distinctive in flight. Female larger than male and brown, but both have white upper-tail-coverts, which are tinged brown in female-like juveniles. Races differ in size and intensity of plumage colours.

Habitat. Marshy edges of lakes and rivers, also rice paddies and adjacent open grassland. On Reunion and in the Comoros uses hillsides and clearings in forest up to mountain peaks, but rarely above 2000 m on Madagascar.

Food and Feeding. Mainly small vertebrates such as frogs, reptiles, rats, birds or nestlings;

also shrews, insects and tenrecs on Reunion. Seen in vicinity of active heronry. Courses low over vegetation, dropping onto prey detected on the ground or foliage below, sometimes standing on ground or perching on low stump. Hunts over forest canopy and along cliff faces, especially on Reunion and in the Comoros.

Breeding. Laying Dec-May on Reunion; Oct in Comoros. Performs twisting aerial display with culling. Builds a nest of grass and weed stems on the ground or on low vegetation. Usually 2-3 eggs (2-6); incubation 33-36 days; chicks have pale grey down; fledging 45-50 days.

Movements. Sedentary on permanent marshes, but nomadic to ephemeral habitats. Used to migrate to lower altitudes during winter on Reunion, but such movements less marked in recent times.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Widely distributed on Madagascar, both coastally and inland, but nowhere common and not present on all wetlands. Exact status on Madagascar undetermined, but total population expected to be larger than those of Reunion or the Comoros. Widespread and common on Reunion, with territory size of 3-6 km² and about 130 pairs; now well adapted to man-altered habitats, although declined up to 1966-1974 due to persecution, some of which continues. In the Comoros, uncommon on Ngazidja and Ndzuani, commoner on Mwali and adjacent islets (possibly 25 pairs, with territory size about 35 km²), and recorded for Maore.

Bibliography. Benson (1960a), Clouet (1976, 1978), Dee (1986), Diamond (1987), Jones, C.G. (1989), Langrand (1990), Langrand & Meyburg (1984), Lever (1987), Louette (1988), Milon *et al.* (1973), Simmons (1991a), Staub (1976), Thibault & Guyot (1988).

79. Long-winged Harrier

Circus buffoni

French: Busard de Buffon

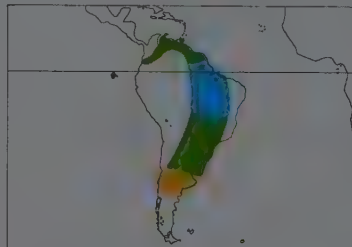
German: Weißbrauenweihe

Spanish: Aguilucho de Azara

Taxonomy. *Falco Buffoni* Gmelin, 1788, northeastern Brazil.

Formerly used name *C. brasiliensis* has page priority, but unidentifiable. Monotypic.

Distribution. SW Colombia to the Guianas, Trinidad and Tobago, and NE Brazil (Pará and Maranhão), then S to E Bolivia, N & C Argentina and C Chile.



Descriptive notes. 48-56 cm; male c. 397 g, female c. 605 g. Particularly long wings and tail, white rump; like other *Circus*, wings held in slight dihedral in coursing flight; has longer wings and more buoyant flight than sympatric congeners. Polymorphic, with melanistic morph. Normal morph male has head and back black, with white supercilium and white dappling on throat; below white with black breast band; underwing pale brownish grey, with black barring and black wingtips; tail grey with white tip and blackish bands, above wing-coverts and flight-feathers grey, remiges tipped black. Female like male, but brown

above, with tawny dappling on throat, brown streaking ventrally and tawny thighs; slightly larger than male. Melanistic morph (both sexes) shows sooty black body and white rump; tail, primaries and underwing as in normal colour morph. Legs and feet pale orange-yellow. Immature, normal morph, as normal morph female, but underparts more broadly streaked brown; dark morph similar to adults, but sooty with white streaking below, thighs and undertail-coverts rufous.

Habitat. Lowland tropical zone, in open fields, marshes, grassland and savanna; usually moderately wet areas. Normally below 690 m, but one record at 2000 m in Argentina; 300-1000 m in Colombia.

Food and Feeding. Birds, reptiles, frogs and mammals; principal prey in Surinam seems to be mammals, but two birds seen eating eggs at a heronry. Hunts by coursing over open country in typical style of harriers.

Breeding. Eggs in Jun, Trinidad; possible nest building in Aug, Colombia. Nests on the ground in rushes. 3-4 eggs in Argentina; 2 eggs in Trinidad. No further information available.

Movements. Migratory, at least in southernmost populations; insufficient data to assess status (resident, migratory or wintering) throughout Brazilian distribution. Birds in N South America were thought to be all migrants from S, but breeding record from Trinidad suggests that others may breed in appropriate habitat in this region. Records from Pacific slope in Colombia and Chile suggest species may occasionally cross Andes. Occasional visitor to Tierra del Fuego; recently recorded on Falkland Is.

Status and Conservation. Not globally threatened. CITES II. Widespread, but apparently rather local. Very poorly known. Rare and local in E Brazil, more frequent in S Brazil. In Colombia, fairly common in NE Meta, less numerous in W Meta, rare in Cauca Valley. Likely to be affected by degradation of wetland habitats.

Bibliography. Amadon (1954, 1964), Banks & Dove (1992), Belton (1984), Blake (1977), Clark, R. (1986), Contreras *et al.* (1990), French (1973), Fjeldså & Krabbe (1990), Haverschmidt (1962), Herklots (1961), Hilty & Brown (1986), Jaksic & Jiménez (1986), Johnson (1965), Meyer de Schauensee & Phelps (1978), de la Peña (1992), Pinto (1964), Rensen & Traylor (1989), Snyder (1966).

80. Spotted Harrier

Circus assimilis

French: Busard tacheté

German: Fleckenweihe

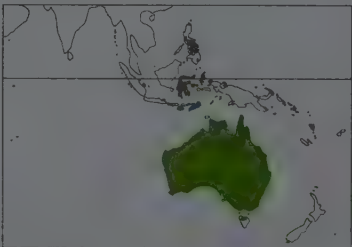
Spanish: Aguilucho Moteado

Other common names: Jardine's/Allied Harrier

Taxonomy. *Circus assimilis* Jardine and Selby, 1828, Sydney, New South Wales.

Formerly recognized race *quirindus* of Sulawesi doubtfully valid. Monotypic.

Distribution. Australia; Sulawesi and Sula Is (C Moluccas); also recorded on Sumba and Timor (Lesser Sundas), but probably migrants.



Descriptive notes. 50-61 cm; male 407-537 g, larger female 540-745 g; wingspan 121-147 cm. Adult plumage unmistakable and unique in genus. Juvenile ginger with dark wings and tail, and prominent rusty shoulders; these features and strongly barred tail distinguish it from greyer or much darker *C. approximans*. Negligible regional variation.

Habitat. Treeless or sparsely wooded grasslands, savannas, plains and cropland; from sea-level to at least 1000 m. Nests in woodland.

Food and Feeding. Terrestrial birds (quails, larks, pipits), mammals (mice) and reptiles; rarely carrion. Forages by low, slow quartering; seizes prey by diving to ground, or by short chase if prey flushed.

Breeding. Usually Sept-Oct in S Australia, exceptionally Mar-Jun; Jun-Sept in N; may rear 2 broods in single year. Solitary. Platform of sticks lined with green leaves, 40-70 cm wide, 16-30 cm deep; placed 2-15 m above ground in live tree (this habit unique in genus). Usually 3 eggs (2-4); incubation 32-34 days; chicks have pale grey down; fledging 36-43 days; post-fledging

dependence at least 6 weeks. Age at first breeding 2 years. Of eggs laid, 56-75% hatching success and 44-57% fledging success; 2-17 per successful nest, 1-3 young per nest, 0.9 per territorial pair. **Movements.** Partly migratory in S, some birds wintering in tropics; status uncertain in Sula Is and Lesser Sundas, but probably only migrant to latter. In S, departure and locality of subsequent return determined by local rainfall: birds leave in dry conditions, return to areas with good rains and plagues of prey.

Status and Conservation. Not globally threatened, CITES II. Generally uncommon but widespread; may have benefited locally in S by creation of habitat, and increase in native and introduced prey. Eggshell thickness not significantly reduced by DDT.

Bibliography. Baker-Gabb (1982a, 1984b, 1984c, 1985a), Baker-Gabb & Fitzherbert (1989), Cupper & Cupper (1981), Hollands (1984), Klapste & Klapste (1982), Klau (1985), Lowe & Lowe (1976), Marchant & Higgins (1993), Olsen & Marples (1993), Olsen, Crome & Olsen (1993), Schodde & Tidemann (1988), Schrader (1985), Tiley (1985), White & Bruce (1986).

81. Black Harrier

Circus maurus

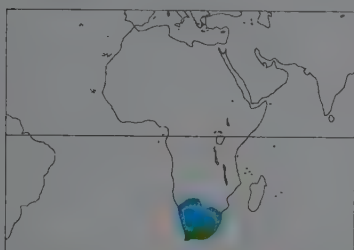
French: Busard maure

German: Mohrenweihe

Spanish: Aguilucho Negro

Taxonomy. *Falco maurus* Temminck, 1828, Cape of Good Hope, South Africa. Monotypic.

Distribution. S South Africa, ranging N to Transvaal, Lesotho, S Namibia and S Botswana.



Descriptive notes. 50 cm. White rump and bands across tail and flight-feathers conspicuous at all ages. Female larger than male. Juvenile brown, with buff edges to dorsal feathers and dark mottling on pale underparts, most similar to female and juvenile of *C. pygargus* and *C. macrourus*. Eye brown in nestling but yellow in juvenile and adult.

Habitat. Breeds in Mediterranean-like fynbos habitat of Cape Floral Kingdom and adjacent karoo scrub and grasslands. Outside breeding season, moves N into drier grassland, scrub and steppe.

Food and Feeding. Mainly small birds, up to

350 g, including nestlings; also eggs, rodents, insects and frogs, rarely carrion. Courses low over vegetation, often checking or hovering before plunging down on prey. Usually rests on ground, sometimes on low perch.

Breeding. Breeds mainly in wet season within winter-rainfall zone of S Cape, also in dry season of adjacent summer-rainfall areas of E Orange Free State and E Natal, South Africa; laying Jul-Sept. 3-4 pairs may nest close to one another with nests only 50 m apart. Makes undulating courtship flight. Builds untidy pad of grass on base of stems, reeds or weeds. Usually 3-4 eggs (2-5); incubation 34 days; chicks have first down white, second down buff; fledging 36-41 days.

Movements. Most birds migrate N in winter to dry steppe and grassland areas of S Namibia, S Botswana and S Transvaal.

Status and Conservation. Not globally threatened, CITES II. Currently considered near-threatened. Widespread and locally common within restricted breeding habitat. An endemic breeding species of South Africa, vulnerable due to limited range and widespread degradation of fynbos breeding habitat. Has adapted well to agricultural croplands, even nesting in wheatfields. Vulnerable to pesticides and rodenticides used on croplands.

Bibliography. Brown *et al.* (1982), Ginn *et al.* (1989), Howe (1989), Hustler (1976), Mackworth-Præd & Grant (1962), Maclean (1993), van der Merwe (1981), Pickford *et al.* (1989), Sinclair *et al.* (1993), Snow (1978), Steyn (1982), Steyn & Meyburg (1989), Tarboton & Allan (1984).

82. Hen Harrier

Circus cyaneus

French: Busard Saint-Martin

German: Kornweihe

Spanish: Aguilucho Pálido

Other common names: Northern Harrier, Marsh Hawk

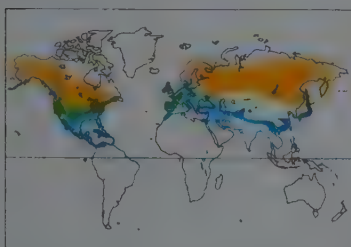
Taxonomy. *Falco cyaneus* Linnaeus, 1766, Europe, Africa = near London.

Forms superspecies with *C. cinereus*, with which it has been considered conspecific. Race *hudsonius* may be separate species. Two subspecies recognized.

Subspecies and Distribution.

C. c. cyaneus (Linnaeus, 1766) - Europe and N Asia E to Kamchatka; winters from Europe and NW Africa through S Asia to SE China and Japan.

C. c. hudsonius (Linnaeus, 1766) - North America, S to NW Mexico and SE Virginia (USA); winters S to N South America.



Descriptive notes. 43-52 cm; male 350 g, female 530 g; wingspan 99-121 cm. Larger and broader-winged than *C. pygargus* and *C. macrourus*, with white rump and dark grey band along trailing edge of secondaries; lacks black bar on upperwing of *C. pygargus*. Female averages larger; dark brown above, pale below with dark streaks; from below, dark bands on primaries, secondaries and rectrices. Juvenile very similar to female, but slightly darker above and more rufous below. Race *hudsonius* has rusty markings on underparts.

Habitat. Open country with some grass or shrub cover, especially grassland, steppe,

meadows, moorland, scrub and cultivation (rye, wheat, alfalfa); also wetlands, especially in North America, and young conifer plantations, in winter more widespread, e.g. over ploughed land. Prefers flat or gently sloping land, although also present on mountain slopes, up to 2500 m and jibow. Range includes colder and more northerly areas than other harriers, N into tundra. Commonly perches on ground, but also on poles, trees or rocks; sleeps on ground, and outside breeding season often gathers in numbers at roosts, which may be traditional; typically 10's of birds, very occasionally up to 200.

Food and Feeding. Small vertebrates: mainly mammals, e.g. voles, mice, cotton rats (*Sigmodon*), ground squirrels, and up to size of young rabbits and hares; also birds of open areas, low vegetation

and wetlands, particularly passerines, e.g. larks, very occasionally up to size of adult Galliformes and ducks. Birds often predominate, in breeding season making up 80% of prey, with many chicks taken; in some moorland areas of Scotland, nearly 30% of prey brought to nest comprises chicks of grouse (*Lagopus*). Also takes some invertebrates, e.g. grasshoppers, crickets; reptiles; amphibians; bird eggs; and, especially in winter, carrion. Normally slow, low foraging flight, relying heavily on hearing prey, which is mainly captured on ground; generally hunts alone; may travel some distance from nest or roost, outside breeding season up to 10 km or more.

Breeding. Laying mid-Apr to early Jul, varying with latitude; normally peaks in May in North America and Europe. Marked tendency locally towards polygyny of males: 2-3 females per breeding male, sometimes more, with up to 7 reported; possibly caused by lack of males, or because species breeds in loose colonies. Nests on ground, in dense grass or scrub, crops or marshy vegetation. Nest is pile of small sticks and grass, 30-60 cm wide, built normally by female. Normally 3-6 eggs (1-7), at interval of 1-3 days; clutch size can vary between good and bad vole years; replacement laying occurs; incubation 29-31 days per egg, by female; chicks brooded continuously at first, with only male bringing food; female also hunts later, but generally closer to nest; chicks have buffy white first down, buffy brown second down; fledging 29-38 days, with males 2-3 days earlier than females; chicks fed several weeks more, with decreasing frequency. Fledging success 1-6 chicks per breeding pair, and 2-4 per successful pair, in Orkney Is, Scotland; respectively 2-2 and 3 in Wisconsin, USA; in Orkney Is 41% of nests fail, largely due to sizeable number of females abandoned in midst of breeding attempt by polygamous males. Sexual maturity normally at 2-3 years, although perhaps 30% of breeding birds breed at one year old. Apparently at least 60% mortality in first year; greater survival rate in females. Some birds live up to 12 years or more; oldest recorded bird 16 years.

Movements. Completely migratory in N of range, in N & NE Europe, Asia, N North America; partially migratory and dispersive in rest of breeding range. Winters from Scotland and S Sweden southwards, with very few birds reaching N Africa; in Asia, winters in area well separated from breeding range, from Turkey to E China and Japan; in America, from British Columbia and New Brunswick (Canada) through Central America to Panama and S to N Colombia, Venezuela and irregularly in Greater Antilles. Leaves for winter quarters from Aug-Oct, or even Nov; arrives in breeding range Mar-May, varying with latitude; migrates on wide fronts.

Status and Conservation. Not globally threatened, CITES II. Population trends vary regionally, but generally seems to be in decline. Notable changes since 19th century: population has increased and expanded widely in British Is, where in early 20th century nested only in Orkney Is and Outer Hebrides; however, in other regions, such as Poland and Ukraine, species has become local. Estimates in 1980's of 2800-3800 pairs in France, 1000-2000 pairs in Sweden, 3000 pairs in Finland, and 300-400 pairs in Spain; in late 1980's, c. 500 pairs in Scotland, and 80-120 pairs in Netherlands; in early 1990's, estimates of 300-500 pairs in Byelorussia, and perhaps 15,000 pairs in European Russia; large numbers in rest of former USSR, particularly in Asian sectors. In North America, stable or with slight decline in 1980's, more notably in E; large reduction in population between 1950's and 1960's, due, at least in part, to organochlorine pesticides; winter population in 1986 in S Canada and USA (most of N American population) reckoned to number c. 110,000 birds. Main threat at present seems to be transformation of habitat, due to intensified agriculture, disappearance of marshes, reforestation, etc.; persecution still severe locally, e.g. on managed grouse moors of Scotland.

Bibliography. Ali & Ripley (1978), Armstrong (1983), Balfour (1957), Balfour & Cadbury (1979), Balfour & Macdonald (1970), Barnard (1982), Belton (1984), Berger (1987), Biaggi (1983), Biedstein (1978), Blake (1977), Brazil (1991), Brazil & Hanawa (1991), Brown *et al.* (1982), Cheng Tso-hin (1987), Cramp & Simmons (1980), Dementiev & Gladkov (1951), Ehrlich *et al.* (1992), Eichecopar & Hüb (1978), Flint *et al.* (1984), Friedmann (1950), Gensbol (1986), Hamerstrom (1986), Handrinos & Demetropoulos (1983), Hilly & Brown (1986), Hou *et al.* (1990), Johnsgard (1990), Kjellen (1992), Marchant *et al.* (1990), Martin, B.P. (1992), Martin, J.W. (1986), Monroe (1968), Nieboer (1973), Palmer (1988), Paz (1987), Picozzi (1978, 1980, 1984), Redpath (1992), Ridgely & Gwynne (1989), Roberts (1991), Rogacheva (1992), Root (1988), Russell (1991), Schipper (1973, 1977, 1978), Schipper *et al.* (1975), Simeonov *et al.* (1990), Simmons (1983, 1989, 1991d), Simmons, Barnard & Smith (1987), Simmons, Macwhirter *et al.* (1986), Slud (1964), Snyder & Snyder (1991), Snyder & Wiley (1976), Stiles & Skutch (1989), Svensson (1991), Watson (1977), Wetmore (1965).

83. Cinereous Harrier

Circus cinereus

French: Busard bariolé

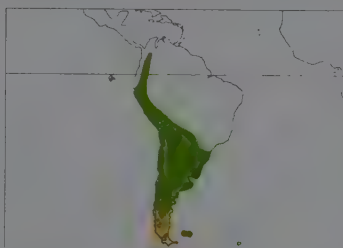
German: Grauweihe

Spanish: Aguilucho Vari

Taxonomy. *Circus cinereus* Vieillot, 1816, Paraguay and near Río de la Plata.

Formerly considered race of *C. cyaneus*, with which it forms superspecies. Monotypic.

Distribution. Colombia and Ecuador (above treeline) S through Peru, Bolivia and Paraguay to extreme S Brazil, then S to Tierra del Fuego and Falkland Is.



Descriptive notes. 40-50 cm; male 340 g, female 500 g. Both sexes have prominent white rump; distinctive rufous barring below. Male pearly grey above, with grey upper breast; otherwise whitish below, boldly barred with bright rufous brown; underwing whitish with black trailing edge and wingtips; tail with conspicuous dark bars below. Iris and legs yellow. Female dark brown above, nape streaked with white; tail greyish; with four narrow blackish bands and broad blackish terminal band; outer rectrices have rufous wash; white below, with irregular grey barring on breast and chestnut barring on belly and undertail-coverts; larger than male.

Immature similar to female, but browner above and mostly whitish below, with dusky vertical streaking particularly on breast and flanks; eye reddish brown.

Habitat. Savannas, pastures and wetlands, near marshes, rivers or streams; in N Argentinian Patagonia, mostly recorded in shrub-steppe, but also river valleys, grassy foothills, shrubland, sedge communities and clearings in *Nothofagus* forest. In Colombia occurs at 1700-3000 m; in Andes, in puna zone up to 4500 m; in S occurs down to sea-level.

Food and Feeding. Mainly birds and other small vertebrates. Diet in Torres del Paine National Park: mostly avian prey, 42%; also small reptiles (Iguanidae), 29%; and mammals, 29%. Takes frogs and some insects; insects can represent large proportion of prey items, but total biomass consumed is small. In Tierra del Fuego, mostly lizards and mammals, very few birds. Hunting technique is typical harrier coursing (flight less than 10 m above ground over open fields, marsh country or scrubland). Said to take some birds on the wing, but most avian prey probably nestlings.

Breeding. In S, nesting reported in Oct-Jan, later than other local raptors, as occurs in *C. cyaneus*; may be timed so that abundance of nestling or fledgling passerines is available when nestling

barriers are being fed. Nest of rushes lined with grass, built on the ground in marshes and pastures. 3-4 eggs, rarely 5; no further information available. Will nest in fairly close proximity to conspecifics, but defends its territory against intrusion by *Circus buffoni*.

Movements. Migratory and resident, but transition between these populations not known. Southernmost birds move N to N Argentina, Paraguay and S Brazil; no records in austral winter (May-Aug) from Isla Grande (Tierra del Fuego). Birds appear erratically in Bolivia, perhaps from S part of range.

Status and Conservation. Not globally threatened. CITES II. Overall in no danger; in S portions of range can be fairly common, in some areas second most abundant raptor after Chimango Caracara (*Milvago chimango*). Particularly common in Tierra del Fuego. Apparently has suffered some decline in Chile and Argentina; in contrast, has increased elsewhere, where forest has been removed. Almost extirpated from Falkland Is, probably as result of destruction of natural grasslands, and also shooting; now seen only rarely, and may no longer breed. Thought to be very local in upland Colombia.

Bibliography. Amadon (1961a), Blake (1977), Cabot & Serrano (1986), Contreras *et al.* (1990), Donazar, Ceballos *et al.* (1993), Field & Krabbe (1990), Goodall *et al.* (1957), Hilly & Brown (1986), Housse (1945), Humphrey *et al.* (1970), Iriarte *et al.* (1990), Jaksic & Jiménez (1986), Jiménez & Jaksic (1988), Johnson (1965), Nores & Yzurieta (1980), de la Peña (1992), Pinto (1964), Sick (1985a, 1993), Thiollay (1991a).

84. Pallid Harrier

Circus macrourus

French: Busard pâle

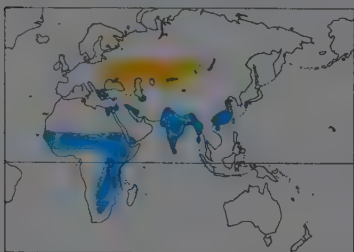
German: Steppenweihe

Spanish: Aguilucho Papialbo

Taxonomy. *Falco macrourus* S. G. Gmelin, 1770, Voronezh, Russia.

Known to have hybridized with *C. pygargus*. Monotypic.

Distribution. Ukraine and SW Russia E to L Balkash region, NW China and perhaps N Mongolia; irregularly breeds farther W to Sweden and Germany. Winters mainly in Africa S of Sahara, and from Pakistan, India and Sri Lanka E to S China, and irregularly to E China.



Descriptive notes. 40-48 cm; male 315 g, female 445 g; wingspan 95-120 cm. Male very pale; only four primaries black. Female similar to females of *C. cyaneus* and especially *C. pygargus*; paler belly, contrasting with more heavily marked breast and head; more defined facial pattern. Juvenile very similar to juvenile *C. pygargus*, with rusty underbody and underwing-coverts, but generally paler; narrow whitish collar.

Habitat. Mainly in natural grassy plains and dry steppes in flat or undulating terrain or on slopes, valleys with steppe vegetation and semi-desert. In winter, uses similar habitats, but also others, e.g. unirrigated wheat fields or sandy islands in Indus Delta (Pakistan), open woodland and mountain plateaux in W Africa; infrequently visits marshes and rice paddies. Outside breeding season may reach up to 3000 m in Himalayas, and rarely over 4000 m in Africa. Roosts colonially during migration and in winter quarters, normally in grass, but also in open; up to 100's of birds together, sometimes along with *C. pygargus* and *C. cyaneus*.

Food and Feeding. Small mammals and birds and, especially in winter quarters, large insects. Takes advantage of demographic explosions of rodents, feeding on voles, mice, gerbils, steppe lemmings (*Lagurus lagurus*) and ground squirrels; birds can be of greater importance, particularly small terrestrial passerines e.g. larks and pipits, and also partridge chicks. Insects include grasshoppers and locusts, and to lesser degree beetles, crickets, dragonflies and others. Reptiles and frogs less often, although lizards (*Lacerta*) common in areas of sand dunes in Pakistan. Flies low, 1-5 m above ground, into wind, dropping onto small prey spotted on ground; spends large part of day hunting. Captures insects fleeing from grass fires.

Breeding. Laying in May-Jun. Solitary or in loose colonies of 3-5 pairs, occasionally up to 30; sometimes with *C. pygargus*. May change breeding area from year to year, with fluctuations in vole populations. Nests on ground, protected by vegetation, e.g. in dry meadows, weeds, low scrub or swamps; nest is pile of grass. Normally 4-5 eggs (3-6); replacement laying can occur; incubation 29-30 days per egg, by female; food brought by male during incubation and early brooding; chicks have buffy white first down, pale cinnamon second down; fledging 35-45 days; chicks stay with adults 2-3 weeks more. Sexual maturity probably at 2-3 years, but sometimes before reaching adult plumage. Oldest recorded bird 13 years.

Movements. Migratory, wintering mainly in sub-Saharan Africa, Indian Subcontinent, Sri Lanka and Burma; rare, or much less common, in Mediterranean Basin, Middle East, Arabia, Iran and S & E China; some birds may remain in S of breeding range. Migrates on broad front; leaves for winter quarters from Aug, mainly in Sept, arriving up to Oct-Nov. Leaves for breeding areas in Mar-Apr; African wintering population moves farther W than in autumn, with some of passage through Maghreb and C Mediterranean. In winter quarters, may make nomadic movements in search of concentrations of food, e.g. locust swarms.

Status and Conservation. Not globally threatened. CITES II. Drastically declining, particularly in Europe. Total population in early 1990's no higher than 20,000 pairs; c. 2000 in European Russia, where spottily distributed, and maximum 5 pairs in Byelorussia; most of population in Asia. Marked reduction in breeding range; in S Ukraine and SW Russia, few breeding sites left in early 1990's, with decline due to exploitation of steppes. Still relatively numerous in part of Asian range and in steppes S of Ural Mts, with 2-2.6-2 pairs per 100 km²; but also reduction in numbers and range, e.g. SC Siberia; estimated c. 90% of population of former USSR occurs in Kazakhstan and S Siberia. No longer nests in Romania; last reported breeding 1956 in Bulgaria, where species had been commonest harrier. Occasional breeder in C Europe; in 1952, invasion year, even bred in Sweden. Decline also evident in fewer birds wintering in Africa; up to 1950's fairly common and locally abundant, particularly in W Africa, where was commonest harrier. Still widespread and fairly common, in Indian Subcontinent and Burma, corresponding to better conservation of E populations. Decline caused by intensification of agriculture, with transformation of natural habitat; also by excessive use of pesticides.

Bibliography. Ali (1979), Ali & Ripley (1978), Benson (1970), Bergier (1987), Brown *et al.* (1982), Cheng Tso-hin (1987), Clarke (1993), Cramp & Simmons (1980), Davygora & Belik (1994), Dementiev & Gladkov (1951), Eidecopar & Hie (1964, 1978), Flint *et al.* (1984), Gallagher & Woodcock (1980), Genschel (1986), Ginn *et al.* (1989), Grimes (1987), Handrinos & Demetropoulos (1983), Henry (1971), Hollom *et al.* (1988), Hie & Eidecopar (1970), Knyshtaus (1993), Lundevall & Rosenberg (1954), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Meyer de Schauensee (1984), Paz (1987), Pickford *et al.* (1989), Pinto (1983), Richardson (1990), Roberts (1991), Rogacheva (1992), Shirihai & Christie (1992), Simeonov *et al.* (1990), Smythies (1986), Svensson (1991), Thiollay (1989).

85. Pied Harrier

Circus melanoleucos

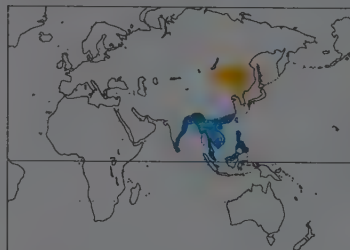
French: Busard tchoug

German: Elsterweihe

Spanish: Aguilucho Pío

Taxonomy. *Falco melanoleucos* Pennant, 1769, Sri Lanka. Monotypic.

Distribution. S Siberia (L. Baikal) and Mongolia E to Amurland, Manchuria and N Korea; has bred in N Burma and NE India (Assam). Winters from India and Sri Lanka to S China, Borneo and Philippines.



Descriptive notes. 41-49 cm; male 265-325 g, female 390-455 g; wingspan 103-116 cm. Male strikingly coloured, with extensive black on head, neck, back, breast, broad wingbar and primaries; forewing, rump and rest of underparts white. Female similar to those of *C. cyaneus*, *C. macrourus* and *C. pygargus*, but generally whiter below and extensively grey on upperwing and uppertail. Juvenile rich cinnamon below, very similar to juveniles of *C. macrourus* and *C. pygargus*.

Habitat. Open ground, including grassland and water meadows, areas of reeds and rushes, semi-steppe, river valleys, swamps, marshes

and bogs; tolerates certain degree of bush cover. In S Asia often in flooded and unflooded paddyfields.

Food and Feeding. Small mammals, especially voles, but also mice and shrews; more occasionally small terrestrial birds and their nestlings, e.g. larks, pipits; also frogs, lizards and insects, e.g. grasshoppers, beetles. Surveys terrain meticulously, using low, buoyant flight typical of genus.

Breeding. Laying in May in Siberia, probably in Apr in N Burma. Nests on ground, in long grass, reedbeds, rushes or sometimes in bushes; nest is thin structure c. 40-50 cm wide, built of grass and other available plant matter. Lays 4-5 eggs, at interval of 2 days; incubation, starting with first egg, mainly by female. Asynchronous hatching, leading to notable size differences between chicks. In Siberia, chicks hunt for themselves from late Aug, when dispersal starts.

Movements. Migratory, except in Assam and Burma, where may well only breed irregularly. Reaches N breeding areas in Apr, males sometimes in first week; leaves for winter quarters mainly in Oct, although starts to disperse earlier, especially juveniles; winters mainly in India and Burma between Sept/Oct and Apr; recorded on migration at Beidaihe (NE China) Aug-Oct, with peak numbers in mid-Sept. In years when rodents plentiful, some birds may spend winter in S Ussuriland and NE China; sometimes winters in Taiwan.

Status and Conservation. Not globally threatened. CITES II. Relatively small range, apparently with limited numbers; population size and trends poorly known; total of 14,534 birds counted migrating over Beidaihe (NE China) in autumn 1986. Rare or even occasional breeder in Assam and N Burma; locally common in SE Siberia and Russian Far East, although in decline due to developing agriculture.

Bibliography. Ali (1979), Ali & Ripley (1978), Austin (1948), Brazil (1991), Brazil & Hanawa (1991), Cheng Tso-hin (1987), Deignan (1945), Dementiev & Gladkov (1951), Dickinson (1986), Dickinson *et al.* (1991), Eidecopar & Hie (1978), Flint *et al.* (1984), Gore & Won (1971), Henry (1971), Inskipp & Inskipp (1985), King *et al.* (1975), Knyshtaus (1993), Lekagul & Round (1991), Long Guo-zhen (1982), MacKinnon & Philipps (1993), Madoc (1976), Medway & Wells (1976), Meyer de Schauensee (1984), Neufeldt (1964), Smythies (1981, 1986).

86. Montagu's Harrier

Circus pygargus

French: Busard cendré

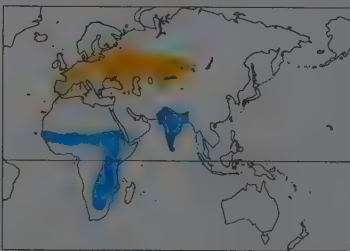
German: Wiesenweihe

Spanish: Aguilucho Cenizo

Taxonomy. *Falco Pygargus* Linnaeus, 1758, England.

Known to have hybridized with *C. macrourus*. Monotypic.

Distribution. NW Africa and S & C Europe E through Caspian lowlands to Kazakhstan and upper R Yenisey. Winters in Africa S of Sahara and Indian Subcontinent S to Sri Lanka.



Descriptive notes. 43-50 cm; male 227-305 g, female 319-445; wingspan 97-115 cm. Normal male has black primaries and black bands across secondaries (1 above, 2 below); narrow white rump. Female slightly paler above than those of *C. macrourus* and *C. cyaneus*. Melanistic morph in male blackish, in female chocolate-coloured. Juvenile darker above than female, with rufous underbody and underwing-coverts; unstreaked below.

Habitat. Open areas with grass or shrubs; generally flat or undulating ground, less often in steeper terrain; from totally undisturbed habitats to those heavily transformed. Grasslands, meadows, fields of cereals (wheat, barley, rye), fallow fields, heath, moor, scrubland, marshes, bogs, peatland, young conifer plantations. Mainly at low altitudes, but up to 1500 m in C Asia, and in African winter quarters recorded up to 4000 m. Perches on small knolls, rocks or trees; roosts on ground, amidst vegetation; may roost colonially; exceptional winter roost in NW India c. 1500 birds.

Food and Feeding. Small ground birds, including many of their young in breeding season; small mammals, mainly voles, which when abundant can constitute nearly all diet; lizards and large insects (e.g. locusts, grasshoppers, mantids) important locally and in winter quarters. Avian prey mostly small passerines, especially larks, and some partridge chicks. Hunts like other harriers, with low, slow flight, quartering narrow strip of land in straight line upwind, and dropping onto prey; nearly always captures prey on ground.

Breeding. Laying mostly in May-Jun; from mid-April in Morocco. Solitary, or in loose groups of up to 10's of pairs; males occasionally bigamous. Nests on ground, in tall, dense vegetation, e.g. grassland, cereal fields, reedbeds, bushy scrub and young conifer plantations. Nest is small, narrow platform, 20-40 cm wide, made of grass stems or thin twigs. Normally 3-5 eggs (1-6), laid at interval of 1-5.3 days; replacement clutch can occur; incubation 28-29 days per egg, by female; chicks fed by female, but prey mostly caught by male; chicks have first and second down white, variably tinged buff; fledging 30-40 days; c. 2 weeks later chicks start to hunt alone, initially

catching insects. Sexual maturity normally at 2-3 years, sometimes in 1st year. Up to 4 chicks fledge; breeding success very variable and highly influenced by human interference, predation and availability of prey, particularly voles. Oldest recorded bird 16 years.

Movements. Migratory; winters in sub-Saharan Africa, Indian Subcontinent and Sri Lanka; few winter records in Europe and Middle East. Leaves European breeding grounds mainly in Aug-Sept, and returns in Apr-May; migrates on broad fronts.

Status and Conservation. Not globally threatened. CITES II. In decline, mainly due to transformation of natural or semi-natural habitats and high rate of breeding failure in agricultural areas, in turn caused by nestlings dying following harvesting of crops. In some areas stable (perhaps in parts of former USSR), even with local increases. Nowadays highly dependent on cultivation and very vulnerable to changes in agricultural practices. In early 1990's, possibly c. 7000 pairs in W Europe; c. 3000 pairs in France, c. 2000 pairs in Spain, 900-1200 pairs in Portugal, c. 110 pairs in Germany, 50-60 pairs in Sweden, 25-30 pairs in Denmark; also c. 150 pairs in Hungary, perhaps 30-50 pairs in Bulgaria, c. 200 pairs in Estonia, 50-150 pairs in Latvia, 30 pairs in Lithuania, and 480-530 pairs in Poland; estimated 600-1100 pairs in Byelorussia, and 25,000 pairs in European

Russia; formerly very common in Ukraine, but on decline since 1930's, and now remains comparatively common only in NE & E. Additional small populations in other European countries; 10's of pairs in Morocco; perhaps 50-100 pairs in Turkey; very little information available on Asian populations. Important protection measures adopted in various European countries, particularly France, based mainly on rescue of nestlings from combine-harvesters; chicks moved to safety during harvesting, or small area round nest is left untouched by farmer (see page 103).

Bibliography. Ali & Ripley (1978), Bergier (1987), Brown *et al.* (1982), Cheng Tso-hin (1987), Clarke (1993), Cormier (1985), Cramp & Simmons (1980), Curry-Lindhal (1981), Dementiev & Gladkov (1951), Etchécopar & Hue (1978), Faralli (1994), Flint *et al.* (1984), Gënsbøl (1986), Giacchini & Pandoliti (1994), Ginn *et al.* (1989), Glutz von Blotzheim *et al.* (1971), Goodman *et al.* (1989), Handrinos & Demetropoulos (1983), Hays (1971), Hiraldo *et al.* (1975), Kitowski (1994), Kjellen (1992), Krogulec & Leroux (1994), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Martin, B.P. (1992), Meyer de Schauensee (1984), Niehoer (1973), Pandoliti & Barucci (1994), Pandolfi & Pino d'Astore (1988, 1990a, 1990b), Paz (1987), Pickford *et al.* (1989), Roberts (1991), Robinson (1950), Rogacheva (1992), Schipper (1973, 1977, 1978), Schipper *et al.* (1975), Shirahai & Christie (1992), Simeonov *et al.* (1990), Thiollay (1989), Underhill-Day (1993).

inches 6
cm 15

PLATE 10

87

88

89

90

91

92

93

94

with
grey face

melanistic
morph

normal morph

with
black face

ssp macroselides

97

ssp canescens

95

96

97

ssp toussenelii

ssp polyzonoides

100

ssp badius

98

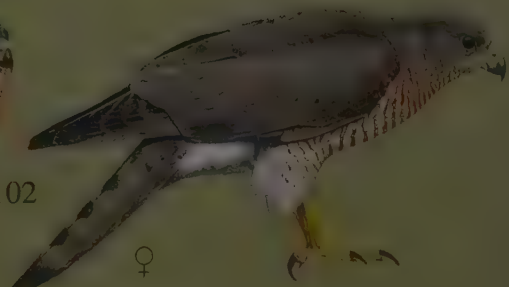
99

ssp sparsifasciatus
melanistic morph

ssp tachiro

101

102



Genus *POLYBOROIDES* A. Smith, 1829

87. African Harrier-hawk

Polyboroides typus

French: Gymnogène d'Afrique **German:** Höhlenweihe **Spanish:** Aguilucho-caricervo Común
Other common names: Gymnogene, Banded Harrier-hawk

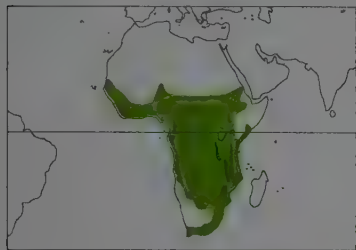
Taxonomy. *Polyboroides typus* A. Smith, 1829, South Africa.

Relationships of genus far from clear, and variously associated with *Dryotriorchis*, *Spilornis*, *Circus* and *Geranospiza*, but possibly closest to *Melierax*. Forms superspecies with *P. radiatus*, with which often considered conspecific. Birds from W Zaire sometimes awarded separate race, *prigoginei*. Two subspecies recognized.

Subspecies and Distribution.

P. t. pectoralis Sharpe, 1903 - Senegambia E to W Sudan, N to Air Mountains (NW Niger) and S to Zaire.

P. t. typus A. Smith, 1829 - E Sudan to Eritrea and S to Angola and South Africa.



Descriptive notes. 65 cm; 555-950 g. Small naked face, flushing from yellow to crimson, voluminous crest feathers and white band across tail notable. Long legs with tibio-tarsal joint flexible through 190°-205° and small feet distinctive, convergent with South American *Geranospiza caerulescens*. Underparts unbarred in some individuals. Juvenile plumage brown, but individually variable in tone and extent of paler markings; recalls juveniles of *Dryotriorchis* and some *Spilornis*, and also adult Crested Caracara (*Polyborus plancus*). Race *pectoralis* smaller and darker, with denser barring on underparts.

Habitat. All forms of forest, woodland and savanna, extending into arid steppe and onto Ethiopian highlands; in extensive tracts of forest is generally restricted to forest edge and rivers passing through.

Food and Feeding. Mainly small animals, such as birds, their eggs and nestlings, bats, squirrels, lizards, various arthropods and insect larvae; these are extracted from nests, holes and crevices in trees, rocks and banks using the slender bill and long, flexibly-jointed legs. Feeds extensively on *Elaeis* oil palm and other fruits in much of lowland tropical Africa; also rarely on carrion. Notable for clambering about and hanging from tree limbs or rock faces with wings dangling; also hunts by slow coursing flight low over vegetation, sometimes searching for nests where most vigorously mobbed by small birds. Takes most prey from trunks and foliage; less frequently from underneath objects on the ground.

Breeding. Laying Nov-Apr in W & NE Africa; Oct in E Kenya; Jun-Dec in S & C Africa. Builds a relatively large nest of sticks in a tree or on a rock ledge, well lined with sprays of green leaves. Usually 2 eggs (1-3); incubation 35 days; chick has first down rufous with long filaments on crown, second down grey; fledging 45-55 days; elder chick usually kills younger sibling soon after hatching, but two chicks may be fledged.

Movements. Resident and sedentary in most areas, but a regular wet season migrant into Sahel zone of W Africa; some vagrancy into marginal habitats, especially in S Africa.

Status and Conservation. Not globally threatened, CITES II. One of commonest birds of prey in forests and woodlands of W and C Africa, especially where oil and *Borassus* palms abundant. 500-1000 pairs in Transvaal, South Africa. Not known to be affected by pesticides.

Bibliography. Benson & Benson (1975), Brosset & Erard (1986), Brown, L.H. (1972a), Brown *et al.* (1982), Burton (1978), Cooper (1980), Ginn *et al.* (1989), Gore (1990), Grimes (1987), Jensen & Kirkeby (1980), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Nikolaus (1987), Pickford *et al.* (1989), Pinto (1983), Smeenk & Smeenk-Enserink (1983), Snow (1978), Steyn (1982), Tarboton & Allan (1984), Thiollay (1975a, 1975b, 1975c, 1976a, 1976b, 1977c, 1978a), Thurow & Black (1981).

88. Madagascar Harrier-hawk

Polyboroides radiatus

French: Gymnogène de Madagascar **Spanish:** Aguilucho-caricervo Malgache
German: Madagaskarhöhlenweihe

Taxonomy. *Vultur radiatus* Scopoli, 1786, Madagascar.

Forms superspecies with *P. typus*, with which often considered conspecific. Monotypic.

Distribution. Madagascar.



Descriptive notes. 68 cm. Very similar to African congener *P. typus*, but generally paler, sometimes with brownish wash; black spotting on scapulars and upperwing-coverts much reduced. Slender build, long thin legs, long broad wings and white band across tail distinctive. Juvenile similar to that of *P. typus*, but much paler below.

Habitat. Forests and woodlands on E and W of Madagascar up to 2000 m. Not on deforested central plateau, although does enter secondary forest.

Food and Feeding. Mainly insects and their larvae or small vertebrates e.g. nestlings, birds' eggs, frogs and reptiles. Larger prey includes a flying-fox, and may also prey on smaller lemurs. Searches for food in a characteristic fashion, clambering over leaf bases of palms, streptitias or epiphytes, examining termite mounds, even peering under or levering over objects on the ground. Spends long periods perched within cover, but sometimes soars high above forest.

Breeding. Laying Jul-Aug. Build a stick nest in the fork of a tree. Usually 2 eggs; no further details recorded.

Movements. None recorded.

Status and Conservation. Not globally threatened. CITES II. One of the five commonest raptors on Madagascar, one bird every 8 km in palm savanna, and one every 105 km overall during road counts. Occurs throughout all wooded areas.

Bibliography. Dee (1986), Goodman & Pidgeon (1991), Langrand (1990), Langrand & Meyburg (1984), Milon *et al.* (1973), Salvan (1971).

Genus *KAUPIFALCO* Bonaparte, 1854

89. Lizard Buzzard

Kaupifalco monogrammicus

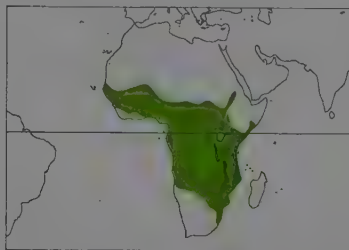
French: Buse unibande **German:** Sperberbussard **Spanish:** Busardo Gavilán

Taxonomy. *Falco monogrammicus* Temminck, 1824, Senegal.

Monotypic genus, probably allied to *Melierax* through plumage, behaviour and yolk colour; traditionally associated with sub-buteonine hawks (see page 55), although interestingly race *meridionalis* was originally described in genus *Micronisus*. Two subspecies recognized.

Subspecies and Distribution.

K. m. monogrammicus (Temminck, 1824) - Senegambia E to Ethiopia and S to Uganda and Kenya.
K. m. meridionalis (Hartlaub, 1860) - S Kenya S to N South Africa and W to Angola and N Namibia.



Descriptive notes. 35 cm; 249-410 g; wingspan 79 cm. Has underparts grey barred with white and white rump, like small, stocky *Melierax*, but with black line down white throat. Morphs with one or two broad white bars across tail. Similar to some South American *Buteo* (*Rupornis*) and *Leucopternis* species. Juvenile similar to adult, with brown wash and paler soft part colours; has brown edges to wing-coverts, and brown not red eye.

Habitat. Moist broad-leaved deciduous woodlands, extending along riverine forest and into adjacent savanna during the rainy season.

Food and Feeding. Mainly insects, especially grasshoppers, lizards and small snakes; also frogs, rodents, arachnids, rarely small birds, and possibly some carrion. Perches for long periods about 8 m up on a conspicuous perch, making fast hard strikes, often into long grass, at any prey detected on the ground below within a radius up to 45 m. Drops from perch to fly close to the ground before swooping up to a new vantage point.

Breeding. Laying Feb-Apr in W & NE Africa; Sept in Gabon; probably all months in Zaire; Jan-Feb and Aug-Oct in E Africa; May-Jan in S & C Africa. Calls or even "sings" regularly from open perch prior to nesting. Builds a small stick nest in an outer fork of a tree, often deeply lined with lichen and leaves. Usually 2 eggs (1-3); incubation 33-34 days; chicks have first down white, second down pale grey; fledging 40 days; 30-40 days post fledging dependence period.

Movements. Resident in many large tracts of woodland. Some irregular local expansion into drier areas of S Africa during the dry season, usually after breeding and while in moult, but also erratically to breed.

Status and Conservation. Not globally threatened. CITES II. Common and quite conspicuous in woodlands of W Africa at 1 pair/80 ha; less abundant in E, C & S Africa. Vulnerable to cutting of woodland and burning or grazing of grass cover, but has extended range into areas cleared of primary forest. Only rarely nests in exotic tree species, and does not adapt readily to open savanna or exotic plantations. Not known to be affected by pesticides.

Bibliography. Benson & Benson (1975), Brown *et al.* (1982), Chapin (1932), Chittenden (1979), Colebrook-Robjent (1986), Ginn *et al.* (1989), Gore (1990), Grimes (1987), Kemp (1986), Mackworth-Praed & Grant (1957-1973), Maclean (1993), von Maltitz *et al.* (1984), Pickford *et al.* (1989), Pinto (1983), Snow (1978), Steyn (1982), Tarboton & Allan (1984), Thiollay (1975a, 1975b, 1975c, 1975d, 1976a, 1976b, 1977a, 1977c, 1978a, 1978c, 1985d), Thiollay & Clobert (1990).

Genus *MELIERAX* G. R. Gray, 1840

90. Dark Chanting-goshawk

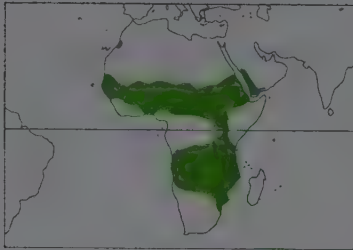
Melierax metabates

French: Autour sombre **German:** Graubürzel-Singhabicht **Spanish:** Azor-lagartijero Oscuro
Other common names: Chanting Goshawk

Taxonomy. *Melierax metabates* Heuglin, 1861, White Nile between lat. 6° N and 7° N, Sudan. Probably forms superspecies with *M. canorus* and *M. poliopterus*. Five subspecies recognized.

Subspecies and Distribution.

M. m. theresae Meinertzhagen, 1939 - SW Morocco.
M. m. neumanni Harten, 1914 - Mali E to N Sudan.
M. m. ignoscens Friedmann, 1928 - SW Arabian Peninsula.
M. m. metabates Heuglin, 1861 - Senegambia E to Ethiopia and S to NE Zaire and N Tanzania.
M. m. meehowi Cabanis, 1882 - Angola E to S Tanzania and S to N Namibia and NE South Africa.



Descriptive notes. 45 cm; male 646-695 g, female 841-852 g; wingspan 101 cm. Generally darker grey on upperparts than *M. canorus* and *M. poliopterus*; plain grey upperwing-coverts; rump barred grey and white; redder cere. Similar at all ages to smaller *Micronisus gabar*, but only outer tail barred. Male usually has paler wing-coverts than female. Juvenile brown, with brown streaking on rump, and pale yellow eye. Races separated on size, intensity of grey and extent of white markings.

Habitat. Moist broad-leaved woodlands and well-wooded savanna, barely overlapping

with drier habitats of congeners.

Food and Feeding. Mainly small vertebrates, especially lizards, snakes and birds, up to size of guineafowl, together with rodents, frogs, some insects and carrion. Hunts mainly from a perch, gliding down to catch prey, even pursuing it on foot. Sometimes rapacious and makes fast sorties and chases through woodland, taking prey in flight. Occasionally follows honeybadgers (*Mellivora capensis*) or ground-hornbills (*Bucorvus*) for prey they disturb.

Breeding. Laying Mar-May in W and NE Africa; Jun-Jul in E Africa; Jul-Nov in S Africa. Vocal, chanting from tree top, before nesting. Builds a platform of sticks, often in a low fork in dense woodland, the nest lined with mud and dry debris, including small bird nests, and often covered in spiders' webs. 1-2 eggs; incubation at least 30 days; chick has white down with long filaments on head; fledging about 36-50 days; juvenile very noisy in nest area for up to 5 months.

Movements. Resident and sedentary in most areas; some movement S in dry season in W Africa, and into NE Zaire in Nov-Apr. Recorded as vagrant to Spain, but record now in doubt.

Status and Conservation. Not globally threatened. CITES II. Widespread and common, especially in C Africa. 400 pairs estimated in Transvaal, South Africa. Vulnerable to cutting of woodland, especially small isolated populations in Morocco and Arabian Peninsula. Not known to be affected by pesticides.

Bibliography. Benson & Benson (1975), Bergier (1987), Brown *et al.* (1982), Colebrook-Robjent (1986), Cramp & Simmons (1980), Etchécopar & Hùe (1964), Gallagher & Woodcock (1980), Génsbel (1986), Ginn *et al.* (1989), Gore (1990), Grimes (1987), Hollom *et al.* (1988), Howland (1988), Jensen & Kirkeby (1980), Lewis & Pomeroy (1989), Lippens & Wille (1976), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Morel & Morel (1990), Nikolaus (1987), Pickford *et al.* (1989), Pinto (1983), Steyn (1982), Tarboton & Allan (1984), Thiollay (1978c).

91. Eastern Chanting-goshawk

Melierax poliopterus

French: Autour à ailes grises

Spanish: Azor-lagartijero Somali

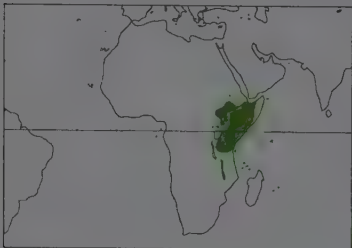
German: Weißbürrzel-Singhabicht

Other common names: Eastern Pale/Somali Chanting-goshawk

Taxonomy. *Melierax poliopterus* Cabanis, 1869, Umba River, Kenya.

Probably forms superspecies with *M. canorus* and *M. metabates*; sometimes considered conspecific with the former, but well separated geographically. Monotypic.

Distribution. SE Ethiopia and Somalia S to E Uganda and N Tanzania.



Descriptive notes. 45-50 cm; male 514-581 g, female 673-802 g. Averages paler than *M. metabates*, with rump pure white. Generally browner than *M. canorus*, with cere and legs more orange. Juvenile brown with white rump; streaked on upper breast and barred below.

Habitat. Dry thorn woodland and savanna.

Food and Feeding. Mainly lizards, also snakes, birds up to size of small francolin, rodents and some large beetles; rarely carrion. Hunts mainly from a prominent tree perch, swooping down for prey on the ground. Rarely walks about or makes fast aerial chase after

small birds.

Breeding. Laying at end of dry season: Feb-Jun in NE Africa; Feb-Jun and Aug-Oct in NW Kenya, where double rainy season occurs, and species may breed biannually. Performs nocturnal communal aerial display with calling on moonlit nights. Builds small stick platform in canopy of densely foliated tree, lined with dry grass and other debris. 1-2 eggs; incubation 36-38 days; chick has grey down with long filaments on head and back; fledging 49-56 days; usually only single chick reared but no sibling aggression observed.

Movements. Generally sedentary but may move out of more arid areas during drought. Makes regular migration N through Taru Desert, Kenya, in Jan-Mar, overflying residents; also absent from other areas (Laikipia Plateau) after breeding.

Status and Conservation. Not globally threatened. CITES II. Widespread, conspicuous and often common in suitable habitat. Home range 1.2-2.1 km² in ideal habitat in Tsavo, Kenya, with densities of 50-60 pairs/100 km². Only vulnerable to cutting of trees, habitat destruction by elephants, and overgrazing of semi-arid habitat. Not known to be affected by pesticides.

Bibliography. Ash & Miskell (1983), Britton (1980), Brown & Amadon (1968), Brown & Britton (1980), Brown *et al.* (1982), Lewis & Pomeroy (1989), Mackworth-Praed & Grant (1957), Rasa (1986, 1987), Short *et al.* (1990), Smeenk & Smeenk-Enserink (1976), Snow (1978).

92. Pale Chanting-goshawk

Melierax canorus

French: Autour chanteur

German: Großer Singhabicht

Spanish: Azor-lagartijero Claro

Other common names: Southern Pale Chanting-goshawk

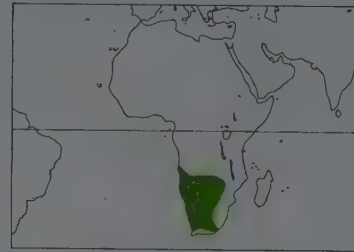
Taxonomy. *Falco canorus* Rislachi, 1799, South Africa.

Probably forms superspecies with *M. poliopterus* and *M. metabates*; sometimes considered conspecific with the former. Two subspecies recognized.

Subspecies and Distribution.

M. c. argenteior Clancey, 1960 - S Angola S and E through Namibia, Botswana and Zimbabwe to NE South Africa in Transvaal and NW Orange Free State.

M. c. canorus (Rislachi, 1799) - S South Africa, in Cape Province, SE Orange Free State and (formerly) S Natal.



Descriptive notes. 46-54 cm; male 493-750 g, female 700-1250 g; wingspan 111 cm. White flecking on greater wing-coverts, pale secondaries and plain white rump notable. Female larger than male. Most similar to browner *M. poliopterus* but secondaries paler; paler and larger than *M. metabates*; much larger than *Micronisus gabar*, with only outer tail barred. Juvenile plumage brown, including upper breast, with pale yellow eye. Races *argenteior* paler.

Habitat. Dry thorn savanna, arid steppe and desert with a few trees or woody succulents.

Food and Feeding. Small vertebrates, especially lizards and rodents, but also birds up to the size of francolin or small bustard, small tortoises, insects and carrion. Hunts mainly from a low perch or while searching about on the ground. Can make swift dashes after prey, taking it in flight; also follows small carnivores for prey they disturb, especially honeybadger (*Mellivora capensis*), jackals and mongooses. Sometimes hunts in pairs, trios or family units.

Breeding. Laying Jun-Dec in S Africa. Chants from prominent perch with tail spread. Builds a stick platform, lined with dung, fur and other dry debris, in upper fork often of a thorny tree, or on a utility pole where trees lacking. Usually 2 eggs (1-2); incubation c. 35 days; chick has white down with long filaments on head; fledging 44 days; breeding trios with an extra male occur. May forgo breeding during drought years.

Movements. No regular movements recorded, but some long distance ringing recoveries of up to 770 km suggest extensive nomadism within arid areas, especially of young birds.

Status and Conservation. Not globally threatened. CITES II. Widespread and common in semi-arid areas, with 400-900 pairs at edge of range in W Transvaal, South Africa. Home range 5.4-6.7 km² in Namibia. Conspicuous, but not often persecuted and may benefit from presence of utility poles in desert areas for hunting from or nesting on. Not known to be affected by pesticides but may be poisoned locally during locust plagues.

Bibliography. Allan (1988b), Biggs *et al.* (1984), Brown *et al.* (1982), Ginn *et al.* (1989), Mackworth-Praed & Grant (1957-1973), Mackworth-Praed & Grant (1962), Maclean (1993), Malan (1992), Malan & Branch (1992), Penzhorn (1976), Pickford *et al.* (1989), Pinto (1983), Smeenk & Smeenk-Enserink (1976), Steyn (1982), Steyn & Meyburg (1992), Tarboton & Allan (1984).

Genus MICRONISUS G. R. Gray, 1840

93. Gabar Goshawk

Micronisus gabar

French: Autour gabar

German: Gabarhabicht

Spanish: Gavilán Gabar

Taxonomy. *Falco gabar* Daudin, 1800, Zwart River, Cape Province, South Africa.

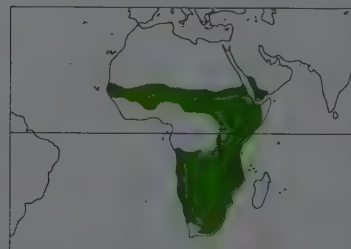
Often included in genus *Melierax*, but may well be closer to *Accipiter*. Three subspecies recognized.

Subspecies and Distribution.

M. g. niger (Vieillot, 1823) - Senegambia E to N Ethiopia and SW Arabia, and S to N Cameroon, Chad and Sudan.

M. g. aequatorius Clancey, 1987 - Ethiopian highlands S to Zaire, Zambia and N Mozambique.

M. g. gabar (Daudin, 1800) - S Angola, Zambia and Mozambique S to South Africa.



Descriptive notes. 28-36 cm; male 110-173 g, female 180-221 g; wingspan 60 cm. Female larger than male. White rump prominent in adult and juvenile of normal phase. Melanistic morph (from hatching, 6-25% of population in different areas), with pale grey bars on flight-feathers and tail; lacks white rump. All phases and morphs similar to *Accipiter ovampensis*, but latter barred up to throat, with only slight white rump, and legs orange, not red. Juvenile brown, with streaks on upper breast and bars on lower breast. Races separated on size and greyiness of plumage.

Habitat. Mainly open thorn savanna, extending to semi-arid steppe along watercourses, and into deciduous broad-leaved woodland.

Food and Feeding. Mainly small birds of 10-80 g, up to 238 g francolin; also small reptiles, mammals and some insects. Hunts from within cover, often in pairs, sometimes in company of Red-necked Falcon (*Falco chicquera*), making fast dashes after prey and continuing into dense cover on foot. May also make low prospecting flights, and often raids or tears into birds' nests to devour contents.

Breeding. Laying usually at end of dry season: Mar-Jun in W & NE Africa; Mar-Nov, with two peaks, in E Africa; Aug-Mar in S Africa (peak Sept-Nov). One marked pair known to have bred twice in one year. Performs aerial and calling displays. Builds small stick nest in crown of an indigenous, often thorny tree, not lined with green leaves or bark like *Accipiter* species. Nest usually and characteristically occupied by and coated with web of colonial spider *Stegodyphus*, probably brought intentionally by hawk for concealment of nest. Usually 2 eggs (2-4); incubation 33-35 days; chicks have white down (grey in melanistic morph); fledging 30-35 days.

Movements. Resident in many areas, but fluctuations in numbers suggest some local movements S in dry season in W Africa. Regular migration N through Taru Desert, Kenya, in Jan-Mar, overflying residents.

Status and Conservation. Not globally threatened. CITES II. Common and widespread through a diverse range of savanna and woodland habitats, although rarely nests in plantations of exotic trees. Nests 4.3-5.8 km apart (Namibia). Bold, even colonizing urban areas, and too small to be serious threat to poultry. Not known to be affected by pesticides.

Bibliography. Benson & Benson (1975), Black & Ross (1970), Brown, C.J. (1986a), Brown, L.H. *et al.* (1982), Clancey (1987b), Colebrook-Robjent (1986), Ginn *et al.* (1989), Grimes (1987), Henschel *et al.* (1991), Herholdt

(1994). Kemp (1986, 1988), Kemp & Kemp (1976), Kemp & Snelling (1973), Lewis & Pomeroy (1989), Mack-worth-Pried & Grant (1957-1973), Maclean (1993), Pickford *et al.* (1989), Pinto (1983), Rasa (1987), Simmons (1986a), Smeenk & Smeenk-Enserik (1976), van Someren (1956), Steyn (1982, 1992), Tarboton & Allan (1984), Thiollay (1978c).

Genus *ACCIPITER* Brisson, 1760

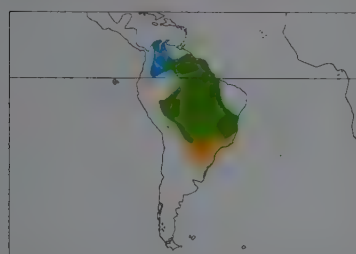
94. Grey-bellied Goshawk

Accipiter poliogaster

French: Autour à ventre gris **German:** Graubauchhähne **Spanish:** Azor Ventrigrís
Other common names: Grey-bellied Hawk

Taxonomy. *Falco poliogaster* Temminck, 1824. São Paulo, Brazil. Birds in the very distinctive immature plumage formerly classified as separate species, *A. pectoralis*. Monotypic.

Distribution. E of Andes from Colombia and NE Ecuador (perhaps only migrants), S Venezuela and the Guianas S through Brazil (except NE), E Peru, Bolivia and Paraguay to N Argentina (Misiones); not recorded between R Negro and R Madeira in W Amazonia.



Descriptive notes. 43-50 cm. Crown and back black, sides of head black or grey; tail has three broad grey bars and white tip; below very pale whitish grey, underwings unbarred; throat and undertail white. Iris, legs and feet yellow. Very similar to Slaty-backed Forest-falcon (*Micrastur mirandollei*), but larger, with shorter square tail. Female larger than male. Immature quite different, and remarkably similar to adult *Spizaetus ornatus*: black crown, chestnut malar patches and nuchal collar continuing onto sides of breast; lower breast and belly white with broad, broken black barring.

Habitat. Rain forest, from lowlands up to 500 m; recorded at margins of riparian forest and in patches of dense woodland. Regularly soars over the forest.

Food and Feeding. No information available; large size suggests relatively large prey, especially birds.

Breeding. No information available.

Movements. Thought to be migratory, at least in extreme S of range. Colombian records may all refer to austral migrants, as all during period Mar-Jun. Transition between presumed migratory and resident populations unknown.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Very little information available. Generally seems to be rare, but wide distribution suggests no immediate overall threat. No recent records from NE Argentina. Estimated average density of at least 3 individuals/10,000 ha at one forest site in French Guiana.

Bibliography. Belton (1984), Blake (1977), Collar & Andrew (1988), Haverschmidt (1972), Hilty & Brown (1986), Jenkinson & Tuttle (1976), Meyburg (1986), Meyer de Schauensee & Phelps (1978), Navas & Bó (1991), Partridge (1961), de la Peña (1992), Pinto (1964), Remsen & Traylor (1989), Sick (1985a, 1993), Snyder (1966), Thiollay (1989a, 1989b), Wattel (1973).

95. Crested Goshawk

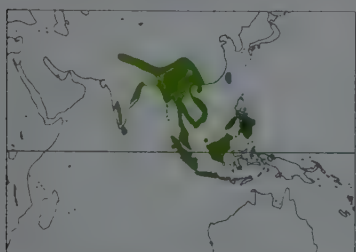
Accipiter trivirgatus

French: Autour huppé **German:** Schopfhähne **Spanish:** Azor Moñudo

Taxonomy. *Falco trivirgatus* Temminck, 1824. Sumatra. Forms superspecies with *A. griseiceps*. Eleven subspecies recognized.

Subspecies and Distribution.

- A. t. luyardi* (Whistler, 1936) - Sri Lanka.
- A. t. peninsulæ* Koelz, 1949 - SW India.
- A. t. indicus* (Hodgson, 1836) - NC, NE & E India and Nepal to S China, including Hainan, and S to Indochina and Malay Peninsula.
- A. t. formosæ* Mayr, 1949 - Taiwan.
- A. t. trivirgatus* (Temminck, 1824) - Sumatra.
- A. t. niasensis* Mayr, 1949 - Nias I (off W Sumatra).
- A. t. javanicus* Mayr, 1949 - Java: recently recorded on Bali.
- A. t. microstictus* Mayr, 1949 - Borneo.
- A. t. palawanus* Mayr, 1949 - Palawan, Calamianes (SW Philippines); may also be race of *Natuna* Is (off W Borneo).
- A. t. extimus* Mayr, 1945 - SE Philippines.
- A. t. castroi* Manuel & Gilliard, 1952 - Polillo Is, off E Luzon (N Philippines).



Descriptive notes. 37-46 cm; 224-450 g; wing-span 65-85 cm. Medium-sized *Accipiter*, with short wings; short, pointed crest usually depressed and not visible; wide dark mesial throat stripe; tail with dark and pale bands of roughly equal width. Female larger and browner than male. Juvenile similar to adult but browner, especially on head, and paler. Racial differences rather slight: island forms generally smaller; some forms darker and more heavily marked, others paler and lightly marked.

Habitat. Moist deciduous and evergreen forest in lowlands and foothills up to 1800 m, and to 2289 m in SC Vietnam.

Food and Feeding. Feeds on small mammals, lizards, frogs, large insects and birds. Prey captured after short, rapid attack launched from concealed perch, usually inside forest. Also takes nestling birds and even bats.

Breeding. Season varies with locality: generally Dec-May, but earlier in S of range: Feb-Jul in Sri Lanka; Jan in Sumatra; Dec-Mar in Java. Large nest built by pair 9-13 m (occasionally higher) up large tree; lined with green leaves. Spectacular display flights include one bird, perhaps male, gliding over territory with white undertail-coverts widely spread and wings drooped. Usually 2 eggs, rarely 1 or 3; incubation c. 34 days. No further information available.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES II. Apparently uncommon to fairly common throughout extensive range; possibly commoner than thought and simply not detected because of unobtrusive habits and preference for forest interiors. Common in Tanjung Puting National Park, C Kalimantan (Borneo). Range reduced in Java due to loss of forest habitat; deforestation is clearly main threat throughout range.

Bibliography. Ali & Ripley (1978), Betts (1947, 1953), Cheng Tso-hin (1987), Deignan (1945, 1963), Dickinson *et al.* (1991), DuPont & Rabor (1973), Eichkopar & Hue (1978), Henry (1971), Inskapp & Inskapp (1985), King *et al.* (1975), Lekagul & Round (1991), MacKinnon (1988), MacKinnon & Phillips (1993), van Marle & Voous (1988), Mayr (1949), Medway & Wells (1976), Meyer de Schauensee (1984), Severinghaus & Blackshaw (1976), Smythies (1981, 1986), Thiollay & Meyburg (1988), Wattel (1973).

96. Sulawesi Goshawk

Accipiter griseiceps

French: Autour de Célèbes **German:** Graukopfhähne **Spanish:** Gavilán de Célebes
Other common names: Sulawesi/Celebes Crested Goshawk

Taxonomy. *Astur griseiceps* Schlegel, 1862. Atep and Gorontalo, northern Sulawesi.

Forms superspecies with *A. trivirgatus*. Monotypic.

Distribution. Sulawesi and off-lying Togian Is, Muna and Butung.



Descriptive notes. 33-38 cm; 212-299 g. Small goshawk with dark upperparts and very small crest; similar in structure to larger *A. trivirgatus*, but underparts streaked all over, and crest much smaller. Juvenile similar to that of *A. trivirgatus*. **Habitat.** Interior of primary and secondary forest; also mangroves and wooded savanna. Occurs from sea-level up to 2000 m.

Food and Feeding. Lizards, small birds, insects, small mammals and occasionally domestic fowl. Prey taken by surprise, often on ground, after short rapid flight from concealed hunting perch in forest.

Breeding. Very little information available.

Season includes May-Jul: laying probably in May, with nestlings heard in late Jun; another pair observed copulating in Jul. Goshawk-sized nest in main fork of not very tall tree in montane forest.

Movements. Apparently sedentary.

Status and Conservation. Not globally threatened. CITES II. Generally reckoned to be uncommon, e.g. in Dumoga-Bone National Park (N Sulawesi); may actually be commoner than thought but infrequently observed due to unobtrusive behaviour.

Bibliography. Andrew (1992), van Bennekel & Voous (1951), Bishop *et al.* (1994), Brown & Amadon (1968), van Marle & Voous (1946), Mayr (1949), Siresmann (1940a), Wattel (1973), White & Bruce (1986).

97. Red-chested Goshawk

Accipiter toussenelii

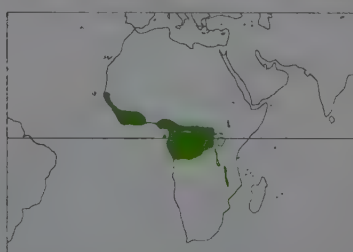
French: Autour de Toussenel **German:** Rotbrusthähne **Spanish:** Azor de Toussenel
Other common names: West African Goshawk

Taxonomy. *Nisus Toussenelii* J. and E. Verreaux, 1855. Gahon.

Forms superspecies with *A. tachiro*, with which often considered conspecific, but differs in size, coloration and apparent lack of display flight. Races *macroselides* and *lopezi* have also been considered to form another full species. Four subspecies recognized.

Subspecies and Distribution.

- A. t. macroselides* (Hartlaub, 1855) - Senegambia to W Cameroon in rain forest.
- A. t. toussenelii* (J. & E. Verreaux, 1855) - S Cameroon to Gabon, in lower Zaire River basin.
- A. t. canescens* (Chapin, 1921) - upper Zaire River basin.
- A. t. lopezi* (Alexander, 1903) - Bioko I (Fernando Po).



Descriptive notes. 35 cm; male 150-235 g, female 270-365 g. Dark upperparts contrast with pale rufous underparts, with little or no barring, white underwing-coverts and white bands across tail; thighs range from white to greyish to reddish. Lowland forest equivalent of larger, well barred *A. tachiro*. Female larger, but similar shade of rufous below to that of male. Juvenile white or only sparsely spotted below, with white or only pale rufous thighs. Races differ in size, intensity of plumage colour and extent of barring on flanks; in equatorial forest belt. W to E cline in percentage of individuals with barred underparts: race *macroselides* small, and fairly well barred below; *canescens* typically lacks barring.

Habitat. Lowland tropical evergreen rain forest and adjacent secondary forest; also montane gallery forest.

Food and Feeding. Small mammals, including squirrels and mice, birds and some frogs, lizards, chameleons, crabs and insects. Attacks free-range poultry. Steals leus and feet suggest preference for larger birds, including hornbills, and mammalian prey (captives in takony regularly kill prey weighing 90-600 g). Hunts mainly from a perch, taking prey after a fast strike from within cover; rarely by surprise after a dashing flight in between vegetation. Active crepuscular.

Breeding. Season Dec-Feb in Ghana; laying Aug, Oct in Sierra Leone, with juveniles frequent in dry season, laying estimated Oct-Nov in Gabon; possibly in breeding condition in Jan and Feb in Zaire. Unlike *A. tachiro*, does not perform regular aerial flight display above territory with repeated single call note. Both sexes build stick platform in tall forest tree; 2 eggs at one nest; no further details recorded.

Movements. No movements recorded.

Status and Conservation. Not globally threatened. CITES II. Widespread and common, with large tracts of forest habitat remaining; in Sierra Leone and Ghana, common throughout lowland forest. Vulnerable to deforestation, but often hunts in secondary growth and along edge of forest. Not known to be affected by pesticides.

Bibliography. Brosset (1969, 1973), Brosset & Erard (1986), Brown *et al.* (1982), Gore (1990), Grimes (1987), Jensen & Kirkeby (1980), Lippens & Wille (1976), Louette (1992), Morel & Morel (1990), Nikolaus (1987), Pinto (1983), Sargeant (1993), Serle *et al.* (1977), Snow (1978), Thiollay (1978c, 1985d), Wattel (1973).

98. African Goshawk

Accipiter tachiro

French: Autour tachiro

German: Afrikahabicht

Spanish: Azor Tachiro

Taxonomy. *Falco tachiro* Daudin, 1800, Knysna district, Cape Province, South Africa.

Forms superspecies with *A. toussenelii*, with which often considered conspecific, but differs in size, coloration and characteristic display flight. Five subspecies recognized.

Subspecies and Distribution.

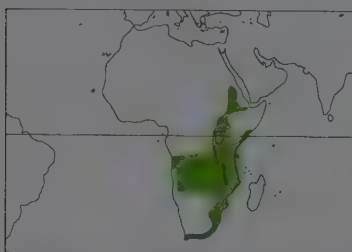
A. t. unduliventer (Rüppell, 1836) - Ethiopian highlands.

A. t. crociati Deshayes, 1974 - SW Ethiopia.

A. t. sparsimfasciatus (Reichenow, 1895) - Somalia, through E Africa, Zanzibar and SE Zaire to N Angola, N Zambia, N Malawi and N Mozambique.

A. t. pembuensis Benson & Elliott, 1975 - Pemba I (Tanzania).

A. t. tachiro (Daudin, 1800) - S Angola, S Zambia, S Malawi and S Mozambique S to South Africa.



Descriptive notes. 35-40 cm; male 160-230 g, female 230-510 g; wingspan 70 cm. Female larger than male, less rufous, with thicker bars below, similar to much smaller *A. minullus*. Juvenile brown with some barring and large spots on underparts, similar to juvenile *Aviceda cuculoides*; eye brown, as opposed to orange in adult; some populations have rufous thighs. Races differ in size, intensity of plumage colour and extent of barring: *sparsimfasciatus* polymorphic, with normal barred morph and dark morph.

Habitat. Dense vegetation, including evergreen, gallery and montane forest, deciduous forest, woodland and riverine forest, exotic plantations and adjacent savanna.

Food and Feeding. Mainly small birds and nestlings, bats and rodents; also squirrels, reptiles, amphibia, crabs and insects. Usually hunts from within cover, making a short dash to capture prey in flight, on the ground or from foliage. Sometimes stoops into canopy from regular high circling flights above forest, or makes fast sub-canopy pursuits. Often hunts at dawn and dusk in low light intensities, and generally inactive around midday.

Breeding. Laying at start of rains: about Jul in W Africa; Mar-Apr and Oct-Dec in E Africa, during both rainy seasons; Sept-Nov in C and S Africa. Regularly flies high over territory loudly repeating a single sharp note. Builds a small platform of sticks high in a forest tree, often concealed among creepers or foliage. Usually 2-3 eggs (1-4); incubation c. 30-35 days; chicks have white down; fledging 32-35 days.

Movements. Apparently resident and sedentary in all areas, but some wandering to more arid habitat during long rains in Kenya.

Status and Conservation. Not globally threatened. CITES II. The commonest and most conspicuous small hawk in most African forest habitats, either when calling above the forest or when perched over roads and paths. Vulnerable to forest clearance, but thrives in many secondary forest and woodland types. Not known to be affected by pesticides. Race *pembuensis* common in 1970's.

Bibliography. Benson & Benson (1975), Black & Ross (1970), Brown *et al.* (1982), Dewhurst (1986), Ginn *et al.* (1989), van Jaarsveld (1988), Kemp & Rautenbach (1987), Lewis & Pomeroy (1989), Lippens & Wille (1976), Louette (1992), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Pakenham (1979), Pickford *et al.* (1989), Pinto (1983), Piper (1989), Rautenbach *et al.* (1990), Simmons (1986a), Snow (1978), van Someren (1956), Steyn (1982), Tarboton & Allan (1984), Vernon (1986), Wattel (1973), Wood (1987).

99. Chestnut-flanked Sparrowhawk

Accipiter castanilius

French: Autour à flancs roux

German: Rotflankenhabicht

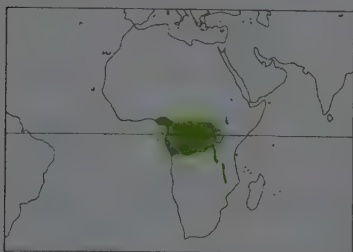
Spanish: Gavilán Flanquirojo

Other common names: Chestnut-flanked Goshawk, Chestnut-bellied Sparrowhawk

Taxonomy. *Accipiter castanilius* Bonaparte, 1853, South America; error, Gabon.

Apparently fairly close to *A. toussenelii* and *A. tachiro*, but distinguished by smaller size and long inner claw. Birds of W Zaire sometimes separated in race *beniensis*, on grounds of larger size. Monotypic.

Distribution. Nigeria E to Zaire River basin. Purported presence in Upper Guinea forests W of Nigeria requires confirmation.



Descriptive notes. c. 30-35 cm; male 135-150 g, female 152-200 g. Saturated colours and heavy grey and brown barring below distinctive: smaller, but longer-tailed and much darker than *A. toussenelii*, which is generally only lightly barred. Male has white bars, rather than spots, on tail. Juvenile has large spots on breast; generally similar to that of *A. toussenelii*, but thighs rusty.

Habitat. Lowland tropical evergreen forest, sometimes extending into dense adjacent secondary growth.

Food and Feeding. Little known, but probably mainly birds (captives in falconry take large insects; birds twice seen trying to catch a fruit bat. Attends parties of birds following driver-ant columns, to catch such birds and other small animals disturbed. Long slender legs and toes suggest mainly avian diet. Normally found perched only 1-3 m up in dense cover, attacking swiftly from such positions.

Breeding. Unrecorded. Laying probably Jan-Apr in Gabon. No aerial flight display reported.

Movements. None recorded; probably resident and sedentary.

Status and Conservation. Not globally threatened. CITES II. Secretive, but thought to be common in larger tracts of pristine forest, of which considerable areas remain. Vulnerable to deforestation, although will enter clearings to hunt; numbers may be much reduced in parts of range. Not known to be affected by pesticides.

Bibliography. Ash (1990), Bannerman (1953), Brosset (1973), Brosset & Erard (1986), Brown *et al.* (1982), Chapin (1932), Lippens & Wille (1976), Louette (1992), Mackworth-Præd & Grant (1970), Pinto (1983), Serle *et al.* (1977), Snow (1978), Thiollay (1978c), Wattel (1973).

100. Shikra

Accipiter badius

French: Épervier shikra

German: Schikrasperber

Spanish: Gavilán Chikra

Other common names: Little Banded Goshawk

Taxonomy. *Falco badius*, Gmelin, 1788, Sri Lanka.

Forms superspecies with *A. butleri* and *A. brevipes*, and perhaps also *A. soloensis* and *A. francescii*. Formerly considered conspecific with *A. brevipes*; sometimes considered to include *A. butleri*. Six subspecies recognized.

Subspecies and Distribution.

A. b. cenchroides (Severtsov, 1873) - Azerbaijan E to Kazakhstan and Iran E to NW India, migrating further S in winter.

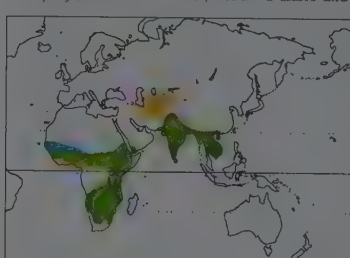
A. b. dumsumieri (Temminck, 1824) - C India and Bangladesh.

A. b. badius (Gmelin, 1788) - SW India and Sri Lanka.

A. b. polioptus (Hume, 1874) - NE India E to S China, S to Thailand and Vietnam.

A. b. sphenurus (Rüppell, 1836) - Senegambia E to SW Arabia, S to N Zaire and N Tanzania.

A. b. polyzonoides A. Smith, 1838 - S Zaire and S Tanzania to N South Africa.



Descriptive notes. 30 cm; 75-158 g; wingspan 58 cm. Pale yellow cere and red (male) or deep orange (female) eye notable. Female larger than male. Juvenile has brown spots on breast, bars on flanks, brown eye and black line down throat. Most similar to *A. brevipes*, but paler below, with fewer, less distinct bars on undertail. Races separated on size, and extent of brown in plumage and rufous below.

Habitat. Deciduous woodland and savanna, from arid steppe to mesic woodland with closed canopy; also small plantations of exotic trees, including suburban gardens.

Food and Feeding. Mainly lizards, geckos

and small birds (9-22 g); also nestlings, eggs, bats, rodents, frogs and insects, rarely carrion. Hunts mainly from a perch within vegetation, making a short dash to take prey on a trunk, in foliage or on ground. Rarely makes aerial pursuits, but generally forceful in attacks on prey. Changes perch with low flap-and-glide flight.

Breeding. Laying usually at end of dry season: Mar-Aug in Sri Lanka; Jan-June in India; Jan-May in W & NE Africa; probably all months in E Africa; Aug-Jan (peak Sept-Nov) in S Africa; late May (spring) in Azerbaijan. Vocal prior to nesting. Builds a small stick nest lined with bark flakes, in an outer fork or on a horizontal branch. Usually 2-3 eggs in Africa, 3-4 in India (1-5), and 3-4 in Azerbaijan (1-7); incubation 30 days in Africa, 33-35 days in Azerbaijan; chicks have pale buff down with white nape; fledging c. 32 days in Africa and India.

Movements. Regular winter migrant S from Palearctic edge of range: some birds move SW to Arabia; most to Pakistan, India and SE Asia. Resident in most other areas of India and in Africa, but in more deciduous habitats moves regularly between drier and wetter savannas. In W Africa moves S in dry season of Oct-Mar, to breed in Guinea woodlands, then N again in wet season; more precise study of movements in W Africa required, e.g. in Senegambia present all year round, but much more numerous in rains. Probably similar but more erratic movements in SW Africa. In Tanu Desert and arid Tsavo, Kenya, moves N in Jan-Mar. Vagrant to Malaysia and Sumatra.

Status and Conservation. Not globally threatened. CITES II. The commonest small hawk of most dry woodland and tree savanna in Africa and India; frequently common near human habitation. Attains densities of 1 pair/2.3 km² in W Africa, or 1 pair/50-117 km² in Transvaal, South Africa; apparently less common in E Africa. Extremely rare in Azerbaijan. One old record from Taiwan. Not known to be affected by pesticides.

Bibliography. Ali & Ripley (1978), Banks (1974), Benson & Benson (1975), Biddulph (1937), Black & Ross (1970), Brown *et al.* (1982), Clark & Parslow (1991), Cramp & Simmons (1980), Etchécopar & Hùe (1978), Flint *et al.* (1984), Gensbøl (1986), Ginn *et al.* (1989), Grimes (1987), Henry (1971), Lamba (1970), Lekagul & Round (1991), Lewis & Pomeroy (1989), Mackworth-Præd & Grant (1962), Maclean (1993), Naoraji (1991), Phillips (1933), Rasa (1987), Roberts (1991), Schmitt *et al.* (1982), Simmons (1986a), Smeenk & Smeenk-Enserik (1977), Smythies (1986), Steyn (1982), Steyn & Barbour (1973), Tarboton (1978b), Tarboton & Allan (1984), Thiollay (1975b, 1975c, 1976b, 1977c, 1977b, 1978a, 1978c), Wattel (1973).

101. Nicobar Sparrowhawk

Accipiter butleri

French: Épervier des Nicobar

German: Nikobarsperber

Spanish: Gavilán de Nicobar

Other common names: Nicobar Shikra, Car Nicobar Shikra.

Taxonomy. *Astur butleri* Gurney, 1898, Car Nicobar.

Sometimes considered a race of *A. badius*, but is quite different in plumage, especially that of juveniles: in structure, being short-winged; and in choice of habitat, a denizen of the upper storeys of forest. Most authorities now consider this a separate species. Forms superspecies with *A. badius* and *A. brevipes*. Two subspecies recognized.

Subspecies and Distribution.

A. b. butleri (Gurney, 1898) - Car Nicobar I (N Nicobar Is).

A. b. obsoletus Richmond, 1902 - Katchall I and possibly Camorta I (C Nicobar Is).

Descriptive notes. 28-34 cm. A small, shy, vocal sparrowhawk with short wings. Differs from larger, darker *A. badius* in single dark subterminal band in tail. Juvenile has rufous upperparts. Race *obsoletus* larger; lacks rufous on underparts.

Habitat. Upper storeys of forest.

Food and Feeding. Apparently mainly lizards; some insects also recorded. Hunting behaviour unreported.



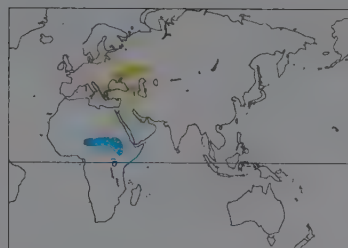
Richmond (1903), Tikader (1988), Wattel (1973).

Breeding. Reproductive activity recorded in Feb and Sept; claim that species breeds twice annually (based on record of juveniles in Sept) seems unlikely. One nest found 12 m up in *Ficus* fig tree, at end of horizontal branch. No further information available.

Movements. Apparently sedentary.

Status and Conservation. Not globally threatened, CITES II. Various reported as not uncommon and fairly common, but not encountered during recent raptor surveys on Car Nicobar.

Bibliography. Ali & Ripley (1978), Brown & Amadon (1968), Butler (1899), Ferguson-Lees & Faull (1992).



size of bee-eaters; some mice and voles; in Africa, insects may predominate. Normally flies low (6-10 m above ground), often hunting in clearings and on edges of woods, sometimes on outskirts of human settlements. Sometimes hunts crepuscularly, and will even take bats. Normally solitary, but pairs may hunt together; during migration may hunt in flocks.

Breeding. Lays in May or early Jun. Nest built in tree, usually in deciduous trees and commonly in alders in some regions; placed on branch near trunk; nest is small platform of sticks lined with twigs and sometimes leaves;

may use other birds' old nests. Normally 3-5 eggs (mean 3.6); replacement laying possible; incubation perhaps 30-35 days per egg, by female; male brings food and female feeds chicks; chicks have white down; fledging c. 45 days; chicks dependent on adults for some weeks more. Sexual maturity at 1 year old.

Movements. Migratory. Most birds leave breeding areas in Sept and return in Apr or early May; believed to winter in sub-Saharan Africa, but winter quarters in Africa not well known. Migrants concentrate around Bosphorus, E Black Sea and especially Israel, where there are peaks during very short periods in second half of Apr and of Sept, and large groups can form; crossing point between Asia and Africa probably at Gulf of Suez. Some nocturnal migration recorded, with birds using flapping flight.

Status and Conservation. Not globally threatened, CITES II. Size and trends of populations insufficiently known, but species less rare than was thought before 1980's. Previously more abundant in SE Europe: e.g. in Bulgaria c. 50 pairs in early 1990's, whilst apparently more numerous than *A. nisus* in mid-20th century. Apparently stable in former USSR, where 2000 pairs estimated in early 1990's, with maximum concentration of 1000-1500 pairs in basin of R Don, but recent estimate of c. 3000 pairs in European Russia alone; c. 80 pairs in SW Ukraine rare in Azerbaijan. Over 40,000 birds pass through Israel each season on migration, with 49,800 in Elat in spring 1987. No reliable information regarding rest of range: very scarce in former Yugoslavia, Romania and Turkey; estimates of up to 1000 pairs in Greece.

Bibliography. Belik (1986a, 1992), Benson (1970), Brown *et al.* (1982), Cramp & Simmons (1980), Dementiev & Gladkov (1951), Esilevskaya & Bryukhanov (1991), Gallagher & Woodcock (1980), Genshel (1986), Goodman *et al.* (1989), Handrinos & Demetropoulos (1983), Hollom *et al.* (1988), Hue & Etchécopar (1970), Jennings (1981), Lesnichy *et al.* (1986), Mackworth-Praed & Grant (1957), Patrikeev (1993), Paz (1987), Shirihai & Christie (1992), Shirihai & Yekutieli (1991), Simeonov *et al.* (1990), Stark & Loeche (1993), Thiollay (1989), Wattel (1973).

102. Levant Sparrowhawk

Accipiter brevipes

French: Épervier à pieds courts German: Kurzfangsperber Spanish: Gavilán Griego

Taxonomy. *Astur brevipes* Severtsov, 1850, Voronezh Province, Russia.

Formerly considered a race of *A. badius*. Forms superspecies with *A. badius* and *A. butleri*. Monotypic.

Distribution. SE Europe, SW Ukraine and S Russia E to W Kazakhstan; more locally in Turkey, Caucasus and Iran. Thought to winter mainly in E Sahel zone of sub-Saharan Africa.

Descriptive notes. 33-38 cm; wingspan 64-80 cm. In flight, contrast from below between almost white underwing and black wingtip; dull blue-grey above; breast and belly pale, lightly barred pinkish or reddish; dark red iris. Female somewhat larger, with browner upperparts; more heavily barred on underparts and underwing; dark streak on throat; lacks white supercilium of female *A. nisus*. Juvenile dark brown above, densely streaked on underparts, with pale spot on hindneck; dark streak on throat, as in female, but more distinct.

Habitat. Wooded plains, particularly in river basins; also foothills and mountain slopes. In Caucasus up to 1000 m, but observed exceptionally up to 2000 m in Armenia. Prefers deciduous trees; often in riparian woodland and copses; also orchards and scrub.

Food and Feeding. Mainly lizards and large insects, e.g. grasshoppers, locusts and other Orthoptera, beetles, cicadas; also variety of small birds, including sparrows, finches and swallows, up to

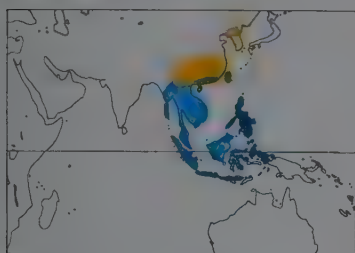


103. Chinese Goshawk

Accipiter soloensis

French: Épervier de Horsfield **German:** Froschsperber **Spanish:** Gavilán Ranero
Other common names: Horsfield's Sparrowhawk, Grey Frog Hawk, Grey Goshawk(!)

Taxonomy. *Falco Soloënsis* Horsfield, 1821, Solo, Java. Sometimes considered to form superspecies with *A. badius*, *A. brevipes*, *A. butleri* and *A. francesii*. Monotypic.
Distribution. S Ussuriland and Korea; C & E China and Taiwan. Winters from extreme SE China and Hainan, S through Indochina, Philippines and Indonesia to W New Guinea and occasionally W Micronesia.



Descriptive notes. 27-35 cm. Resembles *A. badius*, but more slate-coloured above and lacks dark tip to tail; throat white with dark shaft streaks, underparts and underwing-coverts tinged pale rufous, rather than barred; belly and undertail-coverts whitish; white patches on underwing. Also recalls *A. brevipes* and *A. trinitatus*, but differs in pattern and coloration of underparts and tail. Cere, legs and feet generally tinged orange. Female slightly larger, with somewhat more apparent barring below. Juvenile dark brown above, darker than juvenile *A. badius*; underparts densely marked, rufous barring on flanks.

Habitat. Forests and wooded areas, often near paddyfields or wetlands, where most of prey can be found.

Food and Feeding. Main prey probably frogs; also large insects, such as grasshoppers, as well as lizards and small birds. Hunts mainly in open country, scanning from perch; mainly catches prey on ground.

Breeding. Laying in Jun. Nests in tree, in fork or on branch, 8-12 m high; nest built of sticks and lined with green leaves which are added throughout breeding period. Normally 3-4 eggs, occasionally 5; incubation by both adults; both also hunt for chicks, although female normally hunts nearer nest; fledging from 22 days, with young birds beginning to hunt soon after. Adults actively defend nest against intruders, including man.

Movements. Almost completely migratory, although sedentary in Taiwan. Some birds winter in SE China, in Guangdong and on Hainan; most move farther S, reaching Indochina, peninsular Malaysia, Philippines, Greater and Lesser Sundaes, Sulawesi and W tip of New Guinea. Major migration route through Korea, W Kyushu (Japan) and Ryukyu Is towards Taiwan; migration detected in Sept and early Oct, but not well known in spring. Considerable movement recorded over Bali, where 924 birds seen from early Oct to early Nov 1990; movement over N Sulawesi in early Mar and early Oct. Birds arrive in Ussuriland in early May.

Status and Conservation. Not globally threatened. CITES II. Common at least in some areas, and total population probably sizeable. Large number of birds observed on migration in Japan, e.g. over 10,000 birds counted in autumn, coming from N part of range: these would therefore constitute just a small part of population. Common migrant and winter visitor in N Sulawesi, especially in lowlands.

Bibliography. Ali & Ripley (1978), Ash (1993), Bechler *et al.* (1986), Brazil (1991), Brazil & Hanawa (1991), Cheng Tso-hin (1987), Coates (1990), Deignan (1945), Dementiev & Gladkov (1951), Dickinson *et al.* (1991), Etchécopar & Hùe (1978), Gore & Won (1971), Hou *et al.* (1990), King *et al.* (1975), Knystautas (1993), Lekagul & Round (1991), MacKinnon & Philipps (1993), van Marle & Voous (1988), Medway & Wells (1976), Meyer de Schauensee (1984), Pratt *et al.* (1987), Severinghaus & Blackshaw (1976), Smythies (1981), Wattel (1973).

104. Frances's Sparrowhawk

Accipiter francesii

French: Épervier de Frances **German:** Echsenhabicht **Spanish:** Gavilán de Frances
Other common names: Madagascar/Malagasy Goshawk, Frances's/France's Goshawk, France's Sparrowhawk

Taxonomy. *Accipiter Francesii* A. Smith, 1834, Madagascar. Perhaps forms superspecies with *A. badius*, *A. brevipes*, *A. butleri* and *A. soloensis*. The three races of Comoros Is have been considered to constitute a separate species, on grounds mainly of much smaller size. Four subspecies recognized.

Subspecies and Distribution.

- A. f. francesii* A. Smith, 1834 - Madagascar.
- A. f. griveaudi* Benson, 1960 - Ngazidja (Grand Comoro), Comoro Is.
- A. f. pusillus* (Gurney, 1875) - Ndzuani (Anjouan), Comoro Is.
- A. f. brutus* (Schlegel, 1866) - Maore (Mayotte), Comoro Is.



Descriptive notes. 28-35 cm, male 102-116 g. Extent of rufous barring on underparts varies between individual males. Female larger and browner than male, with broader and much more profuse barring below. Juvenile resembles adult female. Races differ markedly in size, colour intensity and extent of barring on underparts; race *griveaudi* heavily barred below, *pusillus* almost unmarked whitish below, both similar in size to *brutus*.

Habitat. All types of primary and secondary forest up to 2000 m, including commercial plantations and suburban gardens. On Ngazidja occurs mainly on the edge of evergreen

forest up to 1800 m.

Food and Feeding. Mainly large insects, such as grasshoppers or beetles, and small vertebrates, such as frogs, chameleons, lizards, rodents and small birds. Usually hunts from a perch with a swift dash after quarry, sometimes in pairs.

Breeding. Laying Sept-Nov on Madagascar and Maore. Builds a substantial stick nest, lined with green leaves, 4.5-7 m up in a densely foliated forest tree, an exotic mango (*Mangifera indica*) near a village, or within an epiphyte on a plantation tree. Usually 3 eggs (3-5); no further details recorded.

Movements. None recorded. The distinct races on separate islands of the Comoro Is suggest a sedentary species.

Status and Conservation. Not globally threatened. CITES II. The commonest *Accipiter* on Madagascar, but uncommon in the arid S. In the Comoros: not common on Ngazidja; once common on Ndzuani, but later (1960) rare, and now probably close to extinction; on Maore was and still is common on moist W side, especially at low altitude. Not recorded from Mwali.

Bibliography. Benson (1960a), Benson *et al.* (1976), Dee (1986), King (1978/79), Langrand (1990), Langrand & Meyburg (1984), Louette (1988), Milon *et al.* (1973), Thibault & Guyot (1988), Wattel (1973)

105. Spot-tailed Goshawk

Accipiter trinitatus

French: Épervier à queue tachetée **German:** Fleckschwanzsperber **Spanish:** Gavilán Colipinto
Other common names: Spot-tailed Accipiter

Taxonomy. *Accipiter trinitatus* Bonaparte, 1850, Sulawesi. May represent old endemic element of Sulawesi. Purported race *haesitandus* of S Sulawesi probably not valid, as variation slight and apparently inconstant. Monotypic.

Distribution. Sulawesi and off-lying islands of Talisei, Muna and Butung.



Descriptive notes. 29-31 cm. Small, vocal *Accipiter*, almost identical in adult plumage to sympatric *A. rhodogaster* and *A. nanus*; leaden grey upperparts and whitish underparts with vinous red wash on breast and upper abdomen. Present species differs in having three (sometimes only two) white spots on uppertail; also longer tarsi and shorter toes, a reflection of its main prey of lizards. Juvenile dimorphic, and quite different from those of *A. rhodogaster* and *A. nanus*; one morph has spotted upperparts; other has unspotted chestnut upperparts.

Habitat. Primary forest in lowlands and hills up to 1600 m; also mangroves and tall secondary forest, occurring from canopy right down to forest floor.

Food and Feeding. Mainly small lizards and snakes, but also frogs, snails, grasshoppers, and occasionally bats and small birds. Moves regularly from one inconspicuous perch within the forest to another; attacks on prey launched from perch.

Breeding. No information available.

Movements. Apparently sedentary.

Status and Conservation. Not globally threatened. CITES II. Common, especially in N Sulawesi; occurrence in secondary forest suggests species may be able to tolerate limited human pressure on habitat.

Bibliography. Andrew (1992), van Bemmelen & Voous (1951), Bishop *et al.* (1994), Brown & Amadon (1968), van Marle & Voous (1946), Stresemann (1940a), Wattel (1973), White & Bruce (1986).

106. Variable Goshawk

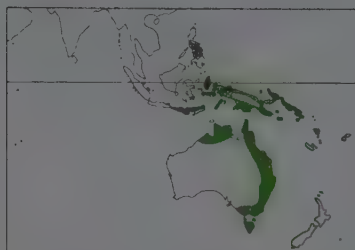
Accipiter novaehollandiae

French: Autour blanc **German:** Grauhabicht **Spanish:** Azor Variable
Other common names: Varied/Grey/White/Vinous-chested/Rufous-breasted/Goshawk; Grey-throated Goshawk (*griseogularis*)

Taxonomy. *Falco novae Hollandiae* Gmelin, 1788, New South Wales. Island races sometimes regarded as a distinct species, *A. hiogaster*, separate from Australian *novaehollandiae*. Moluccan *griseogularis*, *obiensis* and *mortyi* sometimes treated as a separate species, *A. griseogularis*. Race *natalis* of *A. fasciatus* may belong to present species. Polytypic; Australian and New Guinea mainland populations also polymorphic. Twenty-three subspecies normally recognized.

Subspecies and Distribution.

- A. n. sylvestris* Wallace, 1864 - Lesser Sundaes.
- A. n. polionotus* (Salvadori, 1890) - Banda I (Moluccas), Tanjibar Is.
- A. n. albiventris* (Salvadori, 1875) - Tayandu I (Moluccas), Kai Is.
- A. n. obiensis* (Hartert, 1903) - Obi (C Moluccas).
- A. n. griseogularis* (G. R. Gray, 1860) - N Moluccas.
- A. n. mortyi* Hartert, 1925 - Morotai (N Moluccas).
- A. n. hiogaster* (S. Müller, 1841) - S Moluccas.
- A. n. pallidiceps* (Salvadori, 1879) - Buru (S Moluccas).
- A. n. leucosomus* (Sharpe, 1874) - New Guinea.
- A. n. pallidimus* Mayr, 1940 - D'Entrecasteaux Is (New Guinea).
- A. n. manusi* Mayr, 1945 - Admiralty Is.
- A. n. bougainvillei* (Rothschild & Hartert, 1905) - Bougainville (N Solomons).
- A. n. rufoschistaceus* (Rothschild & Hartert, 1902) - Choiseul, Santa Isabel, Florida Is (C Solomon Is).
- A. n. rubianae* (Rothschild & Hartert, 1905) - C Solomon Is.
- A. n. pulchellus* (Ramsay, 1881) - Guadalcanal (SW Solomon Is).
- A. n. malaitae* Mayr, 1931 - Malaita (SE Solomon Is).
- A. n. misulae* Mayr, 1940 - Louisiade Is (New Guinea).
- A. n. misoriensis* (Salvadori, 1875) - Biak I.
- A. n. dampieri* (Gurney, 1882) - New Britain.
- A. n. lavongai* Mayr, 1945 - New Hanover and New Ireland (Bismarck Archipelago).
- A. n. lihirensis* Stresemann, 1933 - Lihir and Tanga Is.
- A. n. matthiae* Mayr, 1945 - St Matthias I (Bismarck Archipelago).
- A. n. novaehollandiae* (Gmelin, 1788) - N & E Australia and Tasmania.



Descriptive notes. Nominate race: 38-55 cm; male 238-470 g, much larger female 515-1050 g; wingspan 71-110 cm. Tropical races smaller: 33-50 cm; male 175-258 g, female 439 g. Australian birds either grey and white, or entirely white. Juvenile grey morph has slight brown collar, and is more coarsely barred with chevrons on breast. Regional variation in size and colour: tropical races darker and more brightly coloured, with rufous underparts; *leucosomus* also has white and sooty morphs; juveniles often resemble juvenile *A. fasciatus*. **Habitat.** Rain forest, open forest, forest edge and adjacent open country; riparian gallery

forest that traverses dry woodland; sea-level to 1450 m. Nests in forest, often near edge, also in woodland; in Queensland (NE Australia), nests in denser habitat than sympatric *A. fasciatus*.

Food and Feeding. Mammals, birds, reptiles, amphibians, arthropods and, rarely, carrion; takes prey up to size of rabbit and heron in Australia, but smaller prey in tropics. Forages mainly by still-hunting from concealed perch in tree canopy; also low, fast flight, quartering and soaring. Seizes prey on ground or perch by dive, stealthy glide or direct flying attack which may become short chase. Drags possums (*Pseudocheirus*) from their dreys.

Breeding. Season Sept-Dec in S Australia, May-Nov in N Australia; season longer in New Guinea; downy young in May on Sumbawa (Lesser Sundas). Solitary breeder. Platform of sticks lined with green leaves, 50-60 cm wide, 35 cm deep; placed up to 15 m above ground in canopy of live tree, often on fork near end of major branch; nest may be reused after successful attempt. Usually 2-3 eggs (2-4); incubation 31-34 days; chicks have white down; fledging c. 30-42 days; post-fledging dependence 38-43 days. Longevity 12 years in captivity. Success: 9 young fledged from 14 eggs; 94% of attempts successful, with failure usually related to tropical thunderstorms in Queensland. **Movements.** Resident; established pairs sedentary, juveniles dispersive.

Status and Conservation. Not globally threatened. CITES II. Uncommon in S and NW Australia, but generally common in tropics. Formerly abundant in Tasmania, but has declined due to clearing of forests, and large numbers still shot; current estimate of 70-110 pairs. Subject to habitat loss in SE Australia. Human disturbance can lead to nest desertion, but species sometimes occurs in urban areas. Eggshell thickness not significantly reduced by DDT use in Australia.

Bibliography. Aumann (1990c), Baker-Gabb (1985c), Beehler *et al.* (1986), Bowler (1989), Burton (1991), Burton *et al.* (1994), Coates (1985), Cupper (1976), Cupper & Cupper (1981), Fleay (1950), Hadden (1981), Hollands (1984), Marchant & Higgins (1993), Mooney & Holdsworth (1988), Olsen & Marples (1993), Olsen & Olsen (1985), Olsen, Crome & Olsen (1993), Olsen, Debus *et al.* (1990), Schodde (1977), Schodde & Tidemann (1988), White & Bruce (1986), Wilson & Whelan (1993)

107. Australasian Goshawk

Accipiter fasciatus

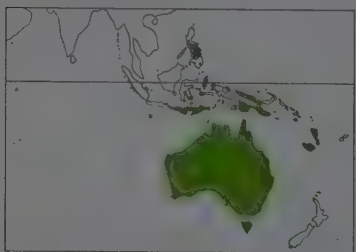
French: Autour australien **German:** Bänderhähcht **Spanish:** Azor Australiano
Other common names: Brown/Australian Goshawk

Taxonomy. *Astur fasciatus* Vigors and Horsfield, 1827, New South Wales.

Birds of Buru (S Moluccas) have traditionally been awarded a separate race, *buruensis*, but identical to Australian birds of race *didimus*; status remains uncertain, as these birds could refer to migrants of *didimus*, or a resident form. Race *natalis* may belong to *A. novaehollandiae* complex, or might even be separate species. Eleven subspecies normally recognized.

Subspecies and Distribution.

- A. f. natalis* (Lister, 1889) - Christmas I (Indian Ocean).
- A. f. tjendunae* Stresemann, 1925 - Sumba (Lesser Sundas).
- A. f. wallacii* (Sharpe, 1874) - Lesser Sundas, from Lombok E to Babar.
- A. f. stresemanni* Rensch, 1931 - islets between Sulawesi and Lesser Sundas.
- A. f. hellmayri* Stresemann, 1922 - Timor, Alor, Roti (Lesser Sundas).
- A. f. sawu* Mayr, 1941 - Sawu (Lesser Sundas).
- A. f. polycryptus* Rothschild & Hartert, 1915 - E New Guinea.
- A. f. dogwa* Rand, 1941 - S New Guinea.
- A. f. didimus* (Mathews, 1912) - N Australia; Buru (S Moluccas).
- A. f. fasciatus* (Vigors & Horsfield, 1827) - Timor (Lesser Sundas); Australia and Tasmania; Rennell and Bellona Is (Solomons).
- A. f. vigilax* Wetmore, 1926 - New Caledonia, Loyalty Is, Vanuatu.



Descriptive notes. Nominate race: 40-55 cm; male 250-415 g, much larger female 440-740 g; wingspan 74-96 cm. Tropical races smaller: *didimus* 37-46 cm; male 200-268 g, female 310-405 g. Medium to large *Accipiter*. Distinguished in all plumages from *A. cirrocephalus* by heavier brow ridges, rounded tail and powerful legs and feet, with shorter middle toe. Tropical races generally distinguished from sympatric races of *A. novaehollandiae* by chestnut collar on hindneck. Juvenile mottled brown, with underparts streaked and barred. Regional variation in size and colour, with tendency in tropical birds for ventral bars

to merge into solid rufous breast-shield.

Habitat. Forest, woodland and scrub, farmland with many trees and urban areas; from sea-level up to 1500 m. Avoids dense rain forest and treeless areas. Nests in forest and woodland; in Queensland (NE Australia), nests in smaller trees and in more open habitat than sympatric *A. novaehollandiae*.

Food and Feeding. Mammals, birds, reptiles, amphibians and arthropods; occasionally carrion. Mostly birds and young rabbits in S, lizards in tropics. Vertebrate prey usually weighs under 500 g, but sometimes over 1000 g. Forages mostly by still-hunting from concealed perch in foliage; also by soaring or low, fast flight. Seizes prey, usually on ground or perch, by stealthy glide or direct flying attack that sometimes becomes a short chase. Also flushes prey from cover, and stalks insects on ground.

Breeding. Sept-Dec; nestlings in late Apr on Sumbawa (Lesser Sundas). Solitary. Platform of sticks 38-70 cm wide, 18-30 cm deep, lined with green leaves; placed 2-36 m above ground in forks of living trees. Usually 3 eggs (2-4); incubation 29-33 days; chicks have white down; fledging 28-37 days; post-fledging dependence over 2 weeks. Sexual maturity at 1 year, though seldom breeds in

juvenile plumage. Mean annual survival 65-79%; oldest ringed bird 11 years. Success 1-6-175 young per attempt, 2-1-2-75 young per successful nest in SE Australia; 62% of attempts successful in Queensland, with failures mainly due to tropical thunderstorms.

Movements. Nominate race partly migratory over most of range; juveniles and some adults (particularly females) from high latitudes and altitudes winter in coastal, lowland and N parts of Australia, exceptionally reaching islands to N. Some adults defend regular winter territories separate from breeding territories. Tropical races largely sedentary, but some *didimus* from inland N Australia winter on N coast and occasionally reach islands to N, e.g. (possibly) Buru, in S Moluccas, whence few records could refer to this race.

Status and Conservation. Not globally threatened. CITES II. Common and widespread; local declines in S Australia where habitat clearance extensive, but species has benefited from introduction of rabbit; preys on introduced birds. Effects of DDT local and insignificant; often illegally shot (mainly juveniles) but effect also insignificant. Isolated Christmas I race vulnerable, owing to very small range, small population size of c. 50-150 pairs, and past habitat clearance and persecution, which has now largely ceased; its biology little known.

Bibliography. Aumann (1988a, 1988b, 1988c, 1988d, 1989a, 1989b, 1990b, 1990c, 1993), Baker-Gabb (1984a, 1984b), Beehler *et al.* (1986), Bregulla (1992), Burton (1991, 1993), Burton *et al.* (1994), Coates (1985), Cupper & Cupper (1981), Currie *et al.* (1993), Czechura *et al.* (1987), Garnett (1992), Hollands (1984), King (1978/79), Marchant & Higgins (1993), Morris (1976a), Newgrain *et al.* (1993a, 1993b), Olsen & Marples (1992, 1993), Olsen & Olsen (1981, 1985, 1987b), Olsen, Crome & Olsen (1993), Olsen, Debus *et al.* (1990), Olsen, Olsen & Mooney (1982), Schodde & Tidemann (1988), Stokes (1988), Thiollay (1993a), White & Bruce (1986).

108. Black-mantled Goshawk

Accipiter melanochlamys

French: Autour à manteau noir **German:** Schwarzmantelhähcht **Spanish:** Gavilán Rufinegro
Other common names: Black-mantled Sparrowhawk

Taxonomy. *Urospizias melanochlamys* Salvadori, 1875, Arfak Mountains, New Guinea.

Forms superspecies with *A. albogularis*, *A. haplochrous* and *A. rufitorques*. Two poorly defined races, doubtfully valid and not recognized by some authorities: eastern birds paler dorsally; differences possibly confounded by sexual characters or plumage wear of specimens. Two subspecies normally recognized.

Subspecies and Distribution.

- A. m. melanochlamys* (Salvadori, 1875) - Vogelkop (W New Guinea).
- A. m. schistacinus* (Rothschild & Hartert, 1903) - montane C & E New Guinea.



Descriptive notes. 30-43 cm; male 172-256 g, larger female 294 g. Medium-sized *Accipiter*. Adult unmistakable, with striking black and chestnut plumage, including broad chestnut collar. Juvenile mottled brown, similar to juveniles of some sympatric *Accipiter* species but head and underparts paler, less densely marked.

Habitat. Montane rain forest, forest edge, regrowth and adjacent native gardens, from 1200 m to 3000 m.

Food and Feeding. Mostly birds, including Papuan Mountain-pigeon (*Gymnophaps albertisii*); also small mammals, frogs and insects.

Flies through forest to seize pigeons among branches; also pursues flying flocks at forest edge and in the air. Has been seen hawking stealthily through gardens and secondary forest, and attacking small birds caught in mist-nets.

Breeding. Nests (presumably typical of genus) built in tall trees, including *Pandanus*, within forest; a male was in breeding condition in Oct. No further information available.

Movements. Unknown; no records outside normal range.

Status and Conservation. Not globally threatened. CITES II. Widespread in all montane areas of mainland New Guinea but lives in remote, rugged and densely forested areas and is seldom encountered by ornithologists. Biology unknown; species possibly affected locally by deforestation.

Bibliography. Andrew (1992), Beehler (1978), Beehler *et al.* (1986), Coates (1985), Diamond (1972), Majnep & Bulmer (1977), Peckover & Filewood (1976), Rand & Gilliard (1967), Ripley (1964), Wattel (1973).

109. Pied Goshawk

Accipiter albogularis

French: Autour pie **German:** Elsterhähcht **Spanish:** Gavilán Pío
Other common names: Pied Sparrowhawk

Taxonomy. *Accipiter albogularis* G. R. Gray, 1870, San Cristobal, Solomon Is.

Forms superspecies with *A. melanochlamys*, *A. haplochrous* and *A. rufitorques*. Five subspecies recognized.

Subspecies and Distribution.

- A. a. eichhorni* Hartert, 1926 - Feni Is (Bismarcks).
- A. a. woodfordi* (Sharpe, 1888) - N, E & S Solomons.
- A. a. albogularis* (G. R. Gray, 1870) - San Cristobal, Santa Ana (Solomons).
- A. a. gilvus* Mayr, 1945 - C Solomons.
- A. a. sharpei* (Oustalet, 1875) - Santa Cruz Is.



Descriptive notes. 33-39 cm; male 170-250 g, larger female 365-440 g. Medium-sized *Accipiter*. Pied adults of most races (except nominate) have a variable rufous collar around hindneck, which distinguishes them from the larger *A. meyerianus* in pied plumage and the smaller *A. imitator*. Some adults melanistic, with plumage entirely slaty black. Juveniles mottled brown, with variable silver underparts; some birds are dark chestnut.

Habitat. Tropical rain forest, forest edge, secondary growth, clearings, native gardens and edge of towns; from sea-level to at least 1800 m. More confined to forest than *A. novaehollandiae*, except on those islands where latter species absent.

Food and Feeding. Poorly known: small birds (including starlings *Aplonis*) and nestlings, rarely up to size of domestic chicken; lizards and insects including phasmatids. Has been seen to flush a flock of Sharp-tailed Sandpipers (*Calidris acuminata*) from ground. Skulks on concealed perches in trees on edge of clearings or gardens; also perches on stumps and other low, exposed perches.

Breeding. Specimens in breeding condition in Sept and Dec; no further information available.

Movements. No information available, but species presumably sedentary as inferred from racial variation between island populations; no records outside normal range.

Status and Conservation. Not globally threatened, CITES II. Appears to be common, at any rate in parts of range, but biology and population trends virtually unknown. Habitat subject to deforestation in lowlands; species may also suffer reproductive failure through eggshell thinning in areas of heavy DDT use, but data lacking. Possibly being replaced by *A. novaeollandiae* in disturbed areas.

Bibliography. Brown & Amadon (1968), Coates (1985), Diamond (1975), Hadden (1981), Mayr (1945a, 1957), Schodde (1977), Watte! (1973), Webb (1992).



PLATE 12

inches 8
cm 20

110. New Caledonia Sparrowhawk

Accipiter haplochrous

French: Autour à ventre blanc

German: Weißbauchhähne

Spanish: Gavilán de Nueva Caledonia

Other common names: White-breasted Sparrowhawk, White-bellied/New Caledonia Goshawk

Taxonomy. *Accipiter haplochrous* P. L. Slater, 1859. Nu Island, off New Caledonia. Forms superspecies with *A. rufitorques*, *A. albugularis* and *A. melanochlamys*. Monotypic.
Distribution. New Caledonia.



Descriptive notes. 32–36 cm; male 152–218 g, larger female 227–281 g. Medium-sized *Accipiter*. Boldly pied adult unmistakable within range; dark cere separates from similar congeners. Juvenile mottled brown and cream, similar to juvenile of larger *A. fasciatus*.

Habitat. Tropical rain forest and forest edge, from sea-level up to 1300 m.

Food and Feeding. Poorly known. Mostly lizards, geckos, insects (grasshoppers, beetles) and small mammals (e.g. *Rattus exulans*). Said to take birds up to size of parrot, pigeon and domestic chicken, but avian prey apparently less important than traditionally held. Perch-

hunter (sit-and-wait method), normally taking prey on ground, but sometimes in trees; regularly hunts from lower perches than *A. fasciatus*, and apparently takes wider range of prey. A fierce predator of birds, sometimes pursuing them into buildings.

Breeding. Birds seen displaying in Sept; nest building and incubation at 2 sites in Oct; 3 eggs collected in Oct, but uncertain whether they were a single clutch of three. No further information.

Movements. Unknown; no records outside normal range.

Status and Conservation. Not globally threatened. CITES II. Restricted distribution, but widespread throughout main island. Occurs at very high densities, with mean of 5.69 birds/km² in optimal habitat; in 1987 total population size estimated to be at least 2500 pairs, and likely to be over 5000 pairs; no evidence of decline. Possibly affected by deforestation, as dependent on forest, and larger congener (*A. fasciatus*) more adapted to open habitats. Likely to be affected by DDT where used, but data lacking.

Bibliography. Brown & Amadon (1968), Hannecart & Letocart (1980), Stokes (1980), Thiollay (1993a), Vuilleumier & Gochfeld (1976), Warner (1947), Wattel (1973).

111. Fiji Goshawk

Accipiter rufitorques

French: Autour des Fidji

German: Fidschihähne

Spanish: Gavilán de las Fiji

Other common names: Grey Goshawk(!)

Taxonomy. *Accipiter rufitorques* Peale, 1848, Fiji.

Forms superspecies with *A. haplochrous*, *A. albugularis* and *A. melanochlamys*. Formerly considered race of *A. fasciatus*; separated by plumage. Monotypic.

Distribution. Fiji Is.



Descriptive notes. 30–40 cm, female larger; male 209 g. Medium-sized *Accipiter*. Adult unmistakable within distribution, where is the only *Accipiter*; smaller and more brightly coloured than *A. fasciatus*, and lacks barring. Juvenile mottled brown; underparts streaked and barred.

Habitat. All wooded habitats, from forest to urban parks; sea-level to 900 m. Nests in forest, forest edge, coconut plantations, and trees in clearings.

Food and Feeding. Small birds up to size of pigeon, occasionally chickens. Also rodents, lizards, crustaceans and large insects; rarely takes small fish and prawns from shallow water. Juveniles occasionally eat carrion. Forages by still-hunting on concealed or un concealed perch in tree, or by low fast flight. Also flies slowly, inspecting tree crowns. Seizes prey by stealthy glide or direct flying attack, which may become short chase. Pursues prey into cover; harries and flushes sheltering prey.

Breeding. Season Jul/Aug–Nov/Dec, with most laying in Sept/Oct; exceptional records in Feb–May may represent late re-nesting, after cyclones disrupt normal season. Solitary. Nest is platform of sticks lined with leaves, commonly 6–16 m (up to 24 m) up in lightly foliated tree, e.g. *Samanea*. Usually 2–3 eggs (2–4); broods of 2 fledglings common.

Movements. Breeding adults presumably sedentary. Juveniles disperse to urban non-breeding territories in Feb; leave in Aug at start of next breeding season.

Status and Conservation. Not globally threatened. CITES II. Small range and total population, but density high, with neighbouring active nests as little as 400 m apart; species common but little studied. Often shot; presumably susceptible to DDT-induced eggshell thinning and consequent breeding depression.

Bibliography. Belcher & Sibson (1972), Blackburn (1971), Clunie (1972a, 1972b, 1981), Clunie & Morse (1984), DuPont (1976), Holyoak (1979), Pratt *et al.* (1987), Watling (1982), Wattel (1973).

112. Moluccan Goshawk

Accipiter henicogrammus

French: Autour des Moluques

German: Halmaherahähne

Spanish: Ázor Moluqueo

Other common names: Gray's Goshawk

Taxonomy. *Accipiter henicogrammus* G. R. Gray, 1860. Halmahera.

Thought by some to be race of *A. fasciatus* or *A. novaehollandiae*, but best retained as full species due to differences in plumage and structure. May represent old endemic element of Moluccas. Monotypic.

Distribution. N Moluccas, on Morotai, Halmahera, Bacan and perhaps Ternate.



Descriptive notes. 38–48 cm. Medium-sized *Accipiter*. Similar in plumage to some forms of *A. novaehollandiae*, but different structure, with particularly rounded wings and longtail, and rather weak feet. Juvenile barred above and below, unusual in *Accipiter*.

Habitat. Forest interior, occasionally forest edge, from sea-level up to 1300 m.

Food and Feeding. Preys on reptiles, small birds, small mammals and insects. Hunting method involves sitting on inconspicuous perch and surprising prey with a quick dash.

Breeding. No information available. May not use display flight; has not been reported to soar.

Movements. Apparently sedentary.

Status and Conservation. Not globally threatened. CITES II. Apparently uncommon, but unobtrusive; possibly commoner than thought.

Bibliography. Andrew (1992), Bishop *et al.* (1994), Brown & Amadon (1968), Wattel (1973), White & Bruce (1986)

113. Slaty-backed Goshawk

Accipiter luteoschistaceus

French: Autour bleu et gris

German: Rabauhähne

Spanish: Gavilán de Nueva Bretaña

Other common names: Slaty-mantled/Blue and Grey Sparrowhawk

Taxonomy. *Accipiter luteoschistaceus* Rothschild and Hartert, 1926. Talasea, New Britain. Monotypic.

Distribution. New Britain.



Descriptive notes. 30–38 cm, female larger; male 205–222 g. Medium-sized *Accipiter*, coloration of underparts ranges from whitish to pale cinnamon. Distinguished from sympatric *A. brachyurus* by orange-red, rather than yellow, facial skin and legs; also by shorter middle toe, and lack of rufous collar. Juvenile has strongly barred rufous upperparts, coarsely barred pale underparts, recalling juvenile of larger *A. henicogrammus*.

Habitat. Forest, forest edge and partly cleared areas of lowlands and hills; from sea-level to at least 700 m.

Food and Feeding. Lizard in stomach of specimen; one bird seen on ground. Morphology suggests that it preys on reptiles and insects. No further information.

Breeding. No information available.

Movements. Unknown; no records outside normal range.

Status and Conservation. Not globally threatened. CITES II. Restricted distribution and presumably low total population size. Apparently scarce, and seldom seen by ornithologists; biology unknown. Habitat subject to deforestation in lowlands.

Bibliography. Brown & Amadon (1968), Coates (1985), Finch & McKean (1987), Gilliard & LeCroy (1967b), Wattel (1973).

114. Imitator Sparrowhawk

Accipiter imitator

French: Autour imitateur

German: Trughähne

Spanish: Gavilán Imitador

Other common names: Little Pied Goshawk/Sparrowhawk, Imitator Goshawk

Taxonomy. *Accipiter eichhornii imitator* Hartert, 1926. Choiseul, Solomon Islands. Monotypic.

Distribution. Bougainville, Choiseul and Santa Isabel, in N & C Solomon Is.



Descriptive notes. 28–33 cm, female larger; female 200–250 g. Medium-sized *Accipiter*. Pied adults in black-breasted plumage readily distinguished from *A. albugularis*; white-breasted adults distinguished by jet black rather than slaty upperparts, and slate black rather than grey underwings. A melanistic (all black) morph may exist; calls said to differ from those of *A. albugularis*, but confirmation of voice and plumages required. Juvenile has brown upperparts with pale mottling on crown, and underparts finely barred rufous.

Habitat. Tropical rain forest and tall secondary forest, from lowlands to 1000 m.

Food and Feeding. Unknown; one bird perched in understorey of forest. Morphology suggests that it lives within dense forest, and may prey on reptiles and insects.

Breeding. No information available.

Movements. Unknown; no records outside normal range.

Status and Conservation. RARE. CITES II. Restricted distribution, and presumably low total population size; habitat subject to deforestation in lowlands. Seldom encountered by ornithologists, and biology unknown.

Bibliography. Brown & Amadon (1968), Coates (1985), Collar & Andrew (1988), Hadden (1981), Mayr (1957), Schodde (1977), Wattel (1973), Webb (1992)

On following pages: 115. Grey-headed Goshawk (*Accipiter poliocephalus*); 116. New Britain Goshawk (*Accipiter princeps*); 117. Tiny Hawk (*Accipiter superciliosus*); 118. Semi-collared Hawk (*Accipiter collaris*); 119. Red-thighed Sparrowhawk (*Accipiter erythropus*); 120. African Little Sparrowhawk (*Accipiter minullus*); 121. Japanese Sparrowhawk (*Accipiter gularis*); 122. Bristle-thighed Sparrowhawk (*Accipiter virgatus*); 123. Sulawesi Dwarf Sparrowhawk (*Accipiter nanus*).

115. Grey-headed Goshawk

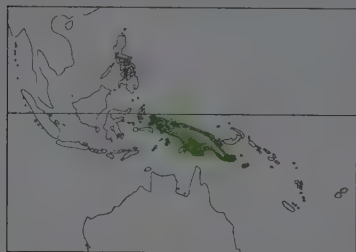
Accipiter poliocephalus

French: Autour à tête grise

German: Aschkopfhäbicht

Spanish: Gavilán Cabecigrís

Other common names: New Guinea (Grey-headed) Goshawk

Taxonomy. *Accipiter poliocephalus* G. R. Gray, 1858, Aru Islands.Forms superspecies with *A. princeps*, with which has been considered conspecific. Monotypic.**Distribution.** W Papuan Is and Aru Is through New Guinea to Fergusson I (D'Entrecasteaux Is) and Misima I and Tagula I (Louisiade Archipelago).**Descriptive notes.** 30-38 cm; male 180-283 g, larger female 225-380 g. Medium-sized *Accipiter*. Adult unmistakable within range; head and nape noticeably paler than rest of upperparts. Juvenile also distinctive, with coarse breast streaking on otherwise white underparts. A possible dark morph has been claimed, but details lacking.**Habitat.** Tropical rain forest, gallery forest, secondary growth and forest edge; from sea-level to 1500 m. Nests in forest and in tall residual trees among regrowth near native gardens.**Food and Feeding.** Poorly known. Mostly lizards; also snakes and insects. Attacks small birds caught in mist-nets. Forages by still-hunting; attacks prey from perch.**Breeding.** Incubation observed at one nest late Aug/early Sept; egg near hatching collected from another nest in Dec. Solitary. Nest is platform of sticks lined with leaves, placed high in tree (one 27 m above ground). One nest in active colony of Metallic Starlings (*Aplonis metallica*). One apparently complete clutch of 1 egg with developing chick inside. No further information.**Movements.** Unknown; no records outside normal range.**Status and Conservation.** Not globally threatened. CITES II. Fairly common and widespread throughout lowlands and hills of mainland New Guinea, including vicinity of native cultivation, but biology poorly known.**Bibliography.** Andrew (1992), Beehler *et al.* (1986), Bell (1984), Coates (1985), Diamond (1972), Harrison & Frith (1970), Mayr & Rand (1937), Peckover & Filewood (1976), Rand & Gilliard (1967), Wattel (1973).

116. New Britain Goshawk

Accipiter princeps

French: Autour de Mayr

German: Prinzenhäbicht

Spanish: Azor de Nueva Bretaña

Taxonomy. *Accipiter princeps* Mayr, 1934, Balayang, Baining Mountains, New Britain.Forms superspecies with *A. poliocephalus*, of which formerly considered a race, but larger and more robust with some differences in adult plumage. Monotypic.**Distribution.** New Britain.**Descriptive notes.** 38-43 cm, female larger. Medium-large *Accipiter*. Adult unmistakable within distribution; darker on head than *A. poliocephalus*, with underwing unbarred. Juvenile not satisfactorily described; possibly similar to juvenile of sympatric *A. meyerianus*. **Habitat.** Hill and montane primary rain forest, 760-1430 m.**Food and Feeding.** Stomach of one specimen contained insects; another killed and ate a Melanesian Ground-thrush (*Zoothera talasea*) caught in a mist-net. No further information.**Breeding.** No information available.**Movements.** Unknown; no records outside

normal range.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Scarce, and seldom encountered by ornithologists; biology unknown.**Bibliography.** Bishop (1983), Brown & Amadon (1968), Coates (1985), Diamond (1971), Mayr (1934), Wattel (1973).

117. Tiny Hawk

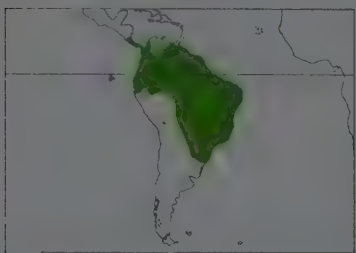
Accipiter superciliosus

French: Épervier nain

German: Däumlingsperber

Spanish: Gavilancito Americano

Other common names: Tiny Sparrowhawk

Taxonomy. *Falco superciliosus* Linnaeus, 1766, Surinam.Forms superspecies with *A. collaris*. Two subspecies recognized.**Subspecies and Distribution.***A. s. fontanieri* Bonaparte, 1853 - Nicaragua S to W Colombia and W Ecuador.*A. s. superciliosus* (Linnaeus, 1766) - E of Andes, from Colombia E through Venezuela (except NW) to the Guianas, and S through Ecuador, E Peru, Bolivia (Beni, Santa Cruz) and Brazil to Paraguay and N Argentina (Misiones).**Descriptive notes.** 24-27.5 cm; male 75 g, female 115-134 g. Tiny *Accipiter*; differs from closely related *A. collaris* by thinner barring on underparts and lack of pale nuchal collar. Crown darker than bluish slate back; tail dark, with three grey bands and narrow white tip which quickly wears off; throat white; underparts, including wing linings, white finely barred with dark greyish brown. Yellow cere and legs, bright red iris. Female browner above; below buff barred with brownish grey; significantly larger than male. Immature has two morphs: greyish brown above with paler feather edgings and dark crown, buff below

with fine cinnamon-rufous barring; or bright rufous above, with dusky barring on back and wings,

reddish buff below barred with reddish brown (adult too said to have rufous morph). Race *fontanieri* has broader, blacker, more distinct barring on underparts.**Habitat.** Lowland rain forest up to 1500 m; perhaps not normally in primary forest, preferring edges of large clearings with isolated forest fragments and patches of secondary forest. Soars over the forest.**Food and Feeding.** Very few data available; these, together with very long toes, suggest a highly specialized predator of birds; one stomach contained rodents. Feeds heavily on hummingbirds, using apparently specialized behaviour: either by still-hunting, or by actively checking perches used for territorial display by the hummingbirds.**Breeding.** Very incompletely known. In Colombia seen carrying sticks in Apr, specimens in breeding condition in Oct and Feb; nest in Feb in Panama; well grown chicks in Aug (mid-dry season), in Manaus, NC Brazil. Stick nest in tall tree; 1 pair usurped abandoned nest of *Busarellus nigricollis*. Clutch size: 1 egg in Panama; 3 in SW Brazil.**Movements.** No evidence of movements.**Status and Conservation.** Not globally threatened. CITES II. Status very poorly known, but large range and tendency to use second growth forest suggest species in no immediate danger.**Bibliography.** Blake (1977), Haverschmidt (1968), Hilty & Brown (1986), Marín *et al.* (1992), Meyer de Schauensee & Phelps (1978), Oniki & Willis (1982), de la Peña (1992), Pinto (1964), Rensen & Ridgely (1980), Rensen & Taylor (1983), Ridgely & Gwynne (1989), Sick (1985a, 1993), Slud (1964), Siles (1978), Thiollay (1985b, 1989a, 1989b, 1991a), Tostain *et al.* (1992), Wetmore (1965).

118. Semi-collared Hawk

Accipiter collaris

French: Épervier à collier interrompu

German: Halsbandsperber

Spanish: Gavilancito Torcaz

Other common names: Collared Sparrowhawk

Taxonomy. *Accipiter collaris* P. L. Sclater, 1860, New Granada = Bogotá, Colombia.Subtropical counterpart of *A. superciliosus*, with which forms superspecies. Monotypic.**Distribution.** SW Venezuela (Mérida, Táchira) S, on W & E slopes of Andes, through Colombia to Ecuador; recent range extension of 1500 km to S Peru.**Descriptive notes.** 25-29 cm. Blackish crown and nape, with broken white nuchal collar, separating from *A. superciliosus*; rest of back blackish brown; throat white, rest of underparts white barred with brownish black; tail grey with five black bands. Iris orange-yellow, cere and legs yellow. Female similar, but larger. Immature has brownish and rufous morphs as in *A. superciliosus*, but brownish morph has incomplete rufous nuchal collar, while rufous morph has conspicuous chestnut collar.**Habitat.** Forest and forest edge, mostly sub-tropical and moist or wet, at 1700 m in Peru, at 600-1800 m in Colombia; occurs at higheraltitude than *A. superciliosus*, but lower than *A. ventralis*.**Food and Feeding.** No information available; presumably takes mostly birds, although heavier feet suggest it may have broader diet than *A. superciliosus*.**Breeding.** No information available.**Movements.** No information available.**Status and Conservation.** Not globally threatened. CITES II. Currently considered near-threatened.

Very little known; thorough surveys needed. Can be relatively abundant within its altitudinal range.

Bibliography. Amadon (1964), Blake (1977), Brown & Amadon (1968), Collar (1986a), Collar & Andrew (1988), Hilty & Brown (1986), Meyburg (1986), Meyer de Schauensee & Phelps (1978), Parker & O'Neill (1980), Thiollay (1991a).

119. Red-thighed Sparrowhawk

Accipiter erythropus

French: Épervier de Hartlaub

German: Waldsperber

Spanish: Gavilancito Muslirrojo

Other common names: Red-thighed/Western Little Sparrowhawk

Taxonomy. *Nisus erythropus* Hartlaub, 1855, Rio Bontry, Ghana.Forms superspecies with *A. minullus*, and sometimes considered conspecific. Two subspecies recognized.**Subspecies and Distribution.***A. e. erythropus* (Hartlaub, 1855) - Senegambia to Nigeria.*A. e. zenkeri* Reichenow, 1894 - Cameroon E to W Uganda and S to N Angola and C Zaire.**Descriptive notes.** 25 cm; male 78-94 g, female 132-170 g. Very small size. Dark upperparts grey, underparts with variable rufous wash or barring, and broken white bars across spread tail distinctive, separating from *A. minullus* of drier forests. Female much larger than male. Juvenile only lightly spotted below with some barring on flanks. Race *zenkeri* very similar, but larger, darker above and sometimes more clearly barred below.**Habitat.** Lowland tropical evergreen rain forest and adjacent secondary forest. In Sierra Leone also occurs in savanna, in areas with thick clumps of trees.**Food and Feeding.** Small birds, such as waxbills or weavers, and large insects, such as caterpillars, butterflies and dragonflies; captives trained for falconry take birds and mice of 8-40 g. Unobtrusive, remaining well below canopy in primary forest, but often hunting along forest border and adjacent secondary growth. Most active at dawn and dusk.**Breeding.** Laying Dec-Mar in Gabon; Mar-May in Sierra Leone; Jul in Zaire. Small stick nest built in tall forest tree, usually in rather open situations, e.g. by edge of swamp or grassland. 2 eggs, further details unrecorded.**Movements.** None recorded. Apparently sedentary.**Status and Conservation.** Not globally threatened. CITES II. Small size suggests may occur at high density in primary forest, large areas of which remain in C Africa. Vulnerable to deforestation, but extends along gallery forest into savanna and will use adjacent dense secondary habitats, so range probably not much reduced in W Africa; widespread but uncommon in Sierra Leone; rare in Gambia. Not known to be affected by pesticides.

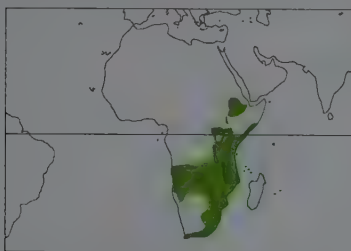
Bibliography. Brosset (1973), Brosset & Erard (1986), Brown *et al.* (1982), Chapin (1932), Gatter (1988), Gore (1990), Grimes (1987), Jensen & Kirkeby (1980), Lippens & Wille (1976), Mackworth-Praed & Grant (1957-1973), Morel & Morel (1990), Pinto (1983), Sargeant (1993), Serle *et al.* (1977), Snow (1978), Thiollay (1985d), Wattel (1973).

120. African Little Sparrowhawk

Accipiter minullus

French: Épervier minule **German:** Zwergsperber **Spanish:** Gavilancito Chico
Other common names: Little Sparrowhawk

Taxonomy. *Falco minullus* Daudin, 1800, Gamtoos River, South Africa.
Forms superspecies with *A. erythropus*, and sometimes considered conspecific. Monotypic.
Distribution. S Sudan and Ethiopia S to South Africa and W to Angola and Namibia.



Descriptive notes. 23-27 cm; male 74-85 g, female 68-105 g; wingspan 39 cm. A tiny woodland hawk. Less rufous than *A. erythropus*, but notable for two pale spots on central tail feathers, like much larger male *A. tachiro*. Female larger and browner than male. Juvenile brown with large spots on white underparts.

Habitat. Patches of woodland and forest, typically along rivers or in valleys; also small plantations of exotic trees in drier savanna.

Food and Feeding. Mainly small birds of 10-40 g, together with some bats, lizards and insects. Hunts from a perch, passing with speed and agility through foliage and taking most

prey on the wing. Pursues some prey to the ground; a bold predator despite its diminutive size.
Breeding. Laying Mar-Apr in NE Africa; Oct-Nov in W Kenya; Aug-Dec in S Africa (peak Oct). Builds a small platform of sticks lined with fine twigs and green leaves, in a high fork of a tree. Usually 2 white eggs (1-3); incubation 31-32 days; chicks have first down white, second down pale brown; fledging 25-27 days.

Movements. Resident where studied but easily overlooked, except for frequent mimicry of calls by local drongos (*Dicrurus*). Some wandering into drier areas in Kenya.

Status and Conservation. Not globally threatened. CITES II. Widespread and common even in small patches of habitat, quickly colonizing new exotic habitats and small plantations. Approximate density of 1 pair/58-88 km² in Transvaal savanna, where estimated 1000 pairs. Not known to be affected by pesticides.

Bibliography. Benson & Benson (1975), Black & Ross (1970), Brown *et al.* (1982), Colebrook-Robjent & Steyn (1975), Craib (1983), Ginn *et al.* (1989), Lewis & Pomeroy (1989), Liversidge (1962), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Pickford *et al.* (1989), Pinto (1983), Simmons (1986a), Snow (1978), Steyn (1972c, 1982), Tarboton & Allan (1984), Thiollay (1978c), Wattel (1973).

121. Japanese Sparrowhawk

Accipiter gularis

French: Épervier du Japon **German:** Trillersperber **Spanish:** Gavilancito Japonés
Other common names: Japanese Lesser/Asiatic Sparrowhawk

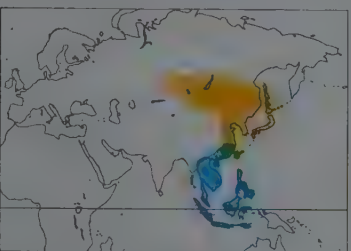
Taxonomy. *Astur (Nisus) gularis* Temminck and Schlegel, 1844, Japan.
Sometimes included in *A. virgatus*, but full species status now generally agreed upon; these two probably form superspecies, possibly along with *A. nanus*. Races sometimes rejected, and species considered monotypic. Three subspecies normally accepted.

Subspecies and Distribution.

A. g. sibiricus Stepanian, 1959 - upper R. Ob and Mongolia E to middle R. Lena, E China and Taiwan; presumably winters from Andaman and Nicobar Is E to S China and Greater Sundas.

A. g. gularis (Temminck & Schlegel, 1844) - Sakhalin, S Kuril Is and Japan; winters S to Philippines, Greater Sundas, N Sulawesi and Timor.

A. g. iwasakii Mishima, 1962 - S Ryukyu Is (Iriomote, Ishigaki).



Descriptive notes. 29-34 cm. Throat with mesial streak narrower than in *A. virgatus* or indistinct; underparts lightly barred. Female slightly larger; dark or greyish brown above, rather than slate grey; more heavily barred on underbody and underwing; iris yellow (red in male). Juvenile dark brown above, with rufous edged feathers; breast streaked brown; belly barred; black mesial streak on throat more marked.

Habitat. Different types of forest, including coniferous (e.g. of firs and spruces in S taiga), deciduous and mixed; also riparian woodland; race *iwasakii* inhabits evergreen subtropical

forest. Normally at low altitudes, although also in hills and mountains; in summer rises to mixed subalpine forests in Japan, and has been reported at 1800 m in Siberia. In Japan has colonized residential areas, even in parts of Tokyo. Hunts in clearings; less restricted to forests in winter.

Food and Feeding. Mostly small forest passerines and occasionally medium-sized birds, e.g. Azure-winged Magpie (*Cyanopica cyanea*) and feral pigeons. In suburban areas of Japan, main prey is Tree Sparrow (*Passer montanus*); fledgling Great Tits (*Parus major*) briefly predominate, when available in mid-May. Occasionally takes small mammals, e.g. rodents, shrews and bats; also some reptiles and insects. Apparently hunts in style similar to that of *A. virgatus* and *A. nisus*.

Breeding. Laying fairly late; mainly Jun in S Siberia, though somewhat earlier in China and Japan. Nests in tree, normally neat trunk, small nest built from twigs and foliage. Normally 2-5 eggs; incubation 25-28 days; chicks fledge in Jun in Japan, in Aug in S Siberia. Nest is defended vigorously against intruders.

Movements. Mainly migratory, although sedentary in Taiwan and S Ryukyu Is; small numbers winter in breeding range, in C & S Japan and S China. Winter visitor from S China to Indochina, Malay Peninsula, Philippines, Greater and Lesser Sundas and N Sulawesi; limited numbers in Burma, considerable movement recorded over Bali, where 78-85 birds seen from early Oct to early Nov. 1989. In Japan birds mostly present from Apr to Sept, in S Siberia possibly from May to Sept or early Oct.

Status and Conservation. Not globally threatened. CITES II. Status and trends of populations very poorly known, with virtually no figures available. Very shy species which seems to be uncommon both in S Siberia and Japan; in Japan, however, has bred in suburban areas since 1981, and currently on increase in such areas. Status uncertain in Andaman and Nicobar Is; said to breed.

Bibliography. Ash (1993), Austin & Kurud (1953), Brazil (1991), Brazil & Hanawa (1991), Bucknill & Chasen (1990), Deignan (1945), Dementiev & Gladkov (1951), Dickinson *et al.* (1991), Endo *et al.* (1991), Etchécopar & Hue (1978), Hirano *et al.* (1988), King *et al.* (1975), Knyshaus (1993), Lekagul & Round (1991), Madoc (1976), van Marle & Voous (1988), Medway & Wells (1976), Meyer de Schauensee (1984), Pratt *et al.* (1987), Rogacheva (1992), Smythies (1981, 1986), Takada (1956), Ueta (1992a, 1992b, 1993, 1994).

122. Besra

Accipiter virgatus

French: Épervier besra **German:** Besrasperber **Spanish:** Gavilán Besra
Other common names: Besra Sparrowhawk

Taxonomy. *Falco virgatus* Temminck, 1822, Java.

Has been considered to include *A. gularis*, with which probably forms superspecies, perhaps also including *A. nanus*. Eleven subspecies recognized.

Subspecies and Distribution.

A. v. affinis (Hodgson, 1836) - N India and Nepal E to C & S China, and Indochina.

A. v. fuscipectus Mees, 1970 - mountains of Taiwan

A. v. hesra Jerdon, 1839 - SW India and Sri Lanka; probably also SE India.

A. v. abdulali Mees, 1980 - Andaman Is. and possibly Nicobar Is.

A. v. nisoides Blyth, 1847 - Burma and Thailand; possibly also Malay Peninsula.

A. v. confusus Hartert, 1910 - Luzon, Mindoro, Negros and Catanduanes (N & E Philippines).

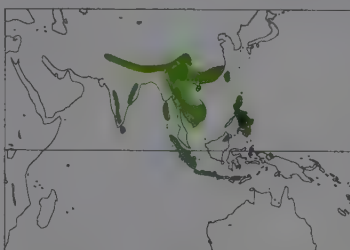
A. v. quagga Parkes, 1973 - Cebu, Bohol, Leyte, Samar, Siquijor and Mindanao (SE Philippines).

A. v. rufotibialis Sharpe, 1887 - N Borneo.

A. v. vanbemmeli Voous, 1950 - Sumatra.

A. v. virgatus Temminck, 1822 - Java and Bali.

A. v. quinquefasciatus Mees, 1984 - Flores (Lesser Sundas).



Descriptive notes. 23-36 cm; 83-140 g; wingspan 50-65 cm. Small sparrowhawk with rounded wings; broad dark mesial throat stripe; dark and light tail bands of equal width. Female larger than male and generally browner. Juvenile brown above, pale below with streaked breast and barred flanks and belly. Races differ primarily in size and colour intensity; *affinis* largest and relatively longest-winged; *rufotibialis* and especially *vanbemmeli* much redder on underparts.

Habitat. Wide variety of forests, including moist deciduous and evergreen; secondary forest, mangroves and pine forest, from sea-

level up to 2400 m. Does not occur in lowlands in some regions (e.g. plains of India and lowland Java) most likely because of removal of forests.

Food and Feeding. Mostly birds, but also insects and lizards. Feeds like typical sparrowhawk, with quick agile chase of birds launched from inconspicuous perch. Prey taken either in air (birds) or, to lesser extent, on ground and trees (lizards, small mammals, insects). Often seen perched on tall dead tree in forest. Regularly soars.

Breeding. Season varies extensively with wide range: Jan-Apr in S India; Mar-Jun in N India; May-Sept in Borneo; Apr, Jul in Philippines; Apr in Sumatra. Small nest built by pair 15-25 m up large tree in forest; lined with green leaves; nest tree often situated on precipice overlooking ravine. Usually 2-4 eggs (up to 5). No further information available.

Movements. Mainly sedentary, but some birds from N India and Nepal may move down onto plains in winter.

Status and Conservation. Not globally threatened. CITES II. Uncommon to common throughout extensive range. May be even commoner, as unobtrusive when not soaring or perched on high snag. Main threat is deforestation, e.g. in much of lowland India, Philippines and Java.

Bibliography. Ali & Ripley (1978), Andrew (1985), Betts (1953), Bishop *et al.* (1994), Cheng Tso-hin (1987), Deignan (1945, 1963), Dickinson *et al.* (1991), Etchécopar & Hue (1978), Henry (1971), Inskipp & Inskipp (1985), King *et al.* (1975), Lekagul & Round (1991), MacKinnon (1988), MacKinnon & Phillips (1993), van Marle & Voous (1988), Mees (1980, 1984), Meyer de Schauensee (1984), Parkes (1973), Riley (1938), Roberts (1991), Smythies (1981, 1986), Thiollay & Meyburg (1988), Tikader (1988), Wattel (1973).

123. Sulawesi Dwarf Sparrowhawk

Accipiter nanus

French: Épervier des Célèbes **German:** Archboldsperber **Spanish:** Gavilancito de Célebes
Other common names: Small/Celebes Sparrowhawk, Celebes Little Sparrowhawk

Taxonomy. *Erythrospizias trinitatus nanus* W. Blasius, 1897, Rurukan, Sulawesi.
May belong in *A. virgatus* superspecies. Monotypic.

Distribution. Mountains of Sulawesi, except SW.



Descriptive notes. 23-28 cm. Small, vocal *Accipiter*, almost identical in adult plumage to sympatric *A. rhodogaster* and *A. trinitatus*, and long confused with former: leaden grey upperparts and vinous red underparts. Present species differs in having white thighs, long toes and little size dimorphism between sexes; lacks white spots on upperpart. Juvenile rufous chestnut above, whitish below with scattered dark streaks.

Habitat. Mountain and hill forest between 900 and 2000 m.

Food and Feeding. Preys on grasshoppers, crickets and other large insects; also small birds

and snails. Takes prey on or near ground after a steep rapid stoop.

Breeding. Only one nest known: discovered in Jun; egg found beneath same nest in Aug. Smallest nest on branch next to trunk of not very tall tree in montane forest. No further information available.

Movements. Apparently sedentary.

Status and Conservation. RARE. CITES II. Apparently uncommon to rare, but status difficult to ascertain because of unobtrusive behaviour. Not known to be directly threatened at present, but loss of forest habitat likely to have negative impact.

Bibliography. Andrew (1992), Bishop *et al.* (1994), Brown & Amadon (1968), Collar & Andrew (1988), Coomans de Bruijn (1947), van Marle & Voous (1988), Sarsom (1932), Hildebrandt (1932), Wille, A. W., 1976.

ssp. erythrauchen

ssp. ceramensis

124

125

126

127

♂

128

♀

melanistic morph

normal morph

129

♀

130

♂

131

ssp. suttoni

132

ssp. striatus

ssp. velox

pale morph

134

dark morph

135

133

rufous morph



124. Rufous-necked Sparrowhawk

Accipiter erythrauchen

French: Épervier à gorge grise **German:** Rotnackensperber **Spanish:** Gavilancito Moluqueño
Other common names: Moluccan/Grey-throated Sparrowhawk, Rufous-necked Collared Sparrowhawk

Taxonomy. *Accipiter erythrauchen* G. R. Gray, 1861, Halmahera.

Closely related to *A. cirrocephalus*; most authorities consider these two to form superspecies with *A. brachyurus* and possibly *A. rhodogaster*. Two subspecies recognized.

Subspecies and Distribution.

A. e. erythrauchen G. R. Gray, 1861 - Motrotai, Halmahera, Bacan and Obi (N Moluccas).
A. e. ceramensis (Schlegel, 1862) - Buru, Ambon and Seram (S Moluccas).



Descriptive notes. 28-35 cm; 156 g (1 bird). Small, slender sparrowhawk distinguished by bright rufous collar; underparts unmarked. Juvenile has typical streaked underparts of genus. Race *ceramensis* slightly larger and blacker above, with some pale grey on underparts.

Habitat. Primary forest in lowlands and hills, from sea-level up to 1400 m. Also in tree plantations and selectively logged lowland forest.

Food and Feeding. Small birds. Prey captured in typical sparrowhawk fashion, after quick dash from hidden perch in forest or at forest edge. One seen chasing Red Lory (*Eos bornea*).

Breeding. No information available.

Movements. Apparently sedentary.

Status and Conservation. Not globally threatened. CITES II. Uncommon, but unobtrusive and easily overlooked. Status very poorly known; most likely threat is loss of forest habitat.

Bibliography. Andrew (1992), Bishop *et al.* (1994), Bowler & Taylor (1989), Brown & Amadon (1968), Deignan (1963), Thiollay & Meyburg (1988), Wattel (1973), White & Bruce (1986).

125. Collared Sparrowhawk

Accipiter cirrocephalus

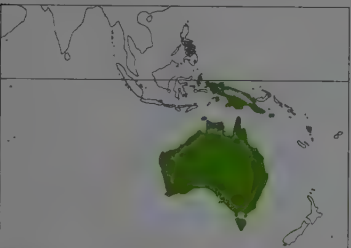
French: Épervier à collier roux **German:** Sydneysperber **Spanish:** Gavilán Acolarado
Other common names: Australian Sparrowhawk

Taxonomy. *Spurivus cirrocephalus* Vieillot, 1817, New Holland = New South Wales.

Forms superspecies with *A. brachyurus*, *A. erythrauchen* and perhaps *A. rhodogaster*. Birds of N Australia sometimes recognized as race *quiescendus*, but doubtfully valid. Emendation of original spelling to *cirrocephalus* is not justified. Three subspecies normally recognized.

Subspecies and Distribution.

A. c. papuanus (Rothschild & Hartert, 1913) - New Guinea, W Papuan Is, Aru Is.
A. c. rossellianus Mayr, 1940 - Rossel I (Louisiade Archipelago).
A. c. cirrocephalus (Vieillot, 1817) - Australia, Tasmania.



Descriptive notes. 29-38 cm; male 98-160 g, much larger female 162-300 g; wingspan 55-78 cm. Small *Accipiter*. Distinguished from sympatric *A. fasciatus* by square or notched rather than rounded tail tip, slender legs, long middle toe. Juvenile mottled brown with streaked and barred underparts. Slight regional variation in size and colour: tropical races less distinctly barred ventrally.

Habitat. Forest, woodland and scrub, including well wooded farmland and urban areas; from sea-level to at least 1500 m in Australia, to 2500 m in New Guinea. Avoids treeless areas and dense, unbroken rain forest. Nests

in forest and woodland, including dense woodlots in large urban parks.

Food and Feeding. Mainly small birds, particularly passerines, including exotic sparrows (*Passer*) and starlings (*Sturnus*); also lizards, insects and rarely small mammals. Most prey under 100 g, rarely over 200 g. Forages by short-stay perch-hunting from concealed position in foliage, punctuated by short flights from tree to tree, often in undulating mode; also by quartering flight or low fast flight, sometimes hedge-hopping. Prey often seized in flight by direct flying attack or stealthy glide that becomes short chase.

Breeding. Jul-Dec. Solitary. Platform of sticks 27-32 cm wide, 12-15 cm deep, lined with green leaves; placed 4-39 m above ground in fork of living tree. Usually 3-4 eggs (2-5); incubation 35 days; chicks have white down; fledging c. 28-33 days; post-fledging dependence of up to 6 weeks. Sexual maturity at 1 year; sometimes breeds in juvenile plumage. Success 1-6 young fledged per clutch laid, 1-7 per successful nest; nestlings sometimes taken by monitor lizards (*Varanus*).

Movements. Poorly understood; apparently some resident and other partly migratory populations, with some birds from S wintering in coastal and N areas; also certain amount of apparently short range post-breeding dispersal, particularly by females, to winter territories, including towns.

Status and Conservation. Not globally threatened. CITES II. Uncommon, but widespread; secretive and probably under-recorded. Local declines in extensively cleared areas, particularly in SW Australia where few exotic passerines; eggshell thickness significantly reduced by DDT use (now ceased) in S Australia, suggesting some local breeding depression. Possibly affected in SE Australia by population explosion of Pied Currawong (*Strepera graculina*), a predator and competitor capable of robbing and injuring adults, or killing nestlings. Sometimes collides with windows; occasionally shot or trapped.

Bibliography. Beehler *et al.* (1986), Coates (1985), Cupper & Cupper (1981), Czechura *et al.* (1987), Debus, Ley *et al.* (1993), Hollands (1984, 1992), Marchant & Higgins (1993), Metcalf *et al.* (1989), Newgrain *et al.* (1993a), Olsen & Marples (1993), Olsen & Olsen (1987a), Olsen, Crome & Olsen (1993), Olsen, Fuller & Marples (1993), Ross *et al.* (1989), Schodde & Tidemann (1988).

126. New Britain Sparrowhawk

Accipiter brachyurus

French: Épervier de Nouvelle-Bretagne **Spanish:** Gavilancito de Nueva Bretaña
German: Dreifarbensperber

Taxonomy. *Astur brachyurus* Ramsay, 1879, New Britain.

Forms superspecies with *A. cirrocephalus*, *A. erythrauchen* and perhaps *A. rhodogaster*. Monotypic.

Distribution. New Britain.



Descriptive notes. 27-34 cm, female larger. Small *Accipiter*. Distinguished from adult of sympatric *A. luteoschistaceus* by yellow (not orange-red) facial skin and legs, long middle toe and rufous collar. Juvenile has strongly barred rufous upperparts, pale underparts coarsely streaked brown.

Habitat. Tropical rain forest, forest edge and partly cleared areas; from sea-level to at least 900 m.

Food and Feeding. Unknown. Morphology suggests that it probably hunts small birds of densely wooded areas.

Breeding. No information available.

Movements. Unknown; no records outside normal range.

Status and Conservation. RARE. CITES II. Scarce, and seldom encountered by ornithologists; population trend and biology unknown. Possibly affected by deforestation in lowlands, and subject to breeding failure through eggshell thinning in areas of DDT use, but data lacking.

Bibliography. Brown & Amadon (1968), Coates (1985), Collar & Andrew (1988), Diamond (1971), Schodde (1978), Wattel (1973).

127. Vinous-breasted Sparrowhawk

Accipiter rhodogaster

French: Épervier à poitrine rousse **German:** Schlegelsperber **Spanish:** Gavilán Pechirrojo

Taxonomy. *Nisus virgatus rhodogaster* Schlegel, 1862, Gorontalo, Sulawesi.

May belong in *A. cirrocephalus* superspecies. Validity of race *butonensis* has been questioned. Three subspecies recognized.

Subspecies and Distribution.

A. r. rhodogaster (Schlegel, 1862) - Sulawesi.
A. r. butonensis Voous, 1951 - Muna and Butung (off SE Sulawesi).
A. r. sulawensis (Schlegel, 1866) - Banggai and Sula Is.



Descriptive notes. 28-33 cm; male 113 g, female 264 g (both juveniles). Small, vocal *Accipiter*, almost identical in adult plumage to sympatric *A. nanus* and *A. trinitatus*; leaden grey upperparts and vinous red underparts, but thighs grey. Present species largest and differs in having grey thighs, long toes and marked sexual dimorphism in size; lacks white spots on uppertail. Juvenile deep rufous above, whitish below with heavy dark streaking. Racial variation slight, mainly in coloration of head, and possibly also in size.

Habitat. Primary and old secondary forest, from sea-level up to 2000 m; also mangroves

and cultivated areas with some woodlands.

Food and Feeding. Stomach contents were insects, lizards, squirrels, mice and small birds. Hunting behaviour unreported.

Breeding. No information available.

Movements. Apparently sedentary.

Status and Conservation. Not globally threatened. CITES II. Widespread and apparently uncommon; perhaps commoner than thought, but overlooked because of unobtrusive habits.

Bibliography. Andrew (1992), van Bemmelen & Voous (1951), Bishop *et al.* (1994), Brown & Amadon (1968), van Marle & Voous (1946), Stresemann (1940a), Wattel (1973), White & Bruce (1986).

128. Madagascar Sparrowhawk

Accipiter madagascariensis

French: Épervier de Madagascar **German:** Madagaskarsperber **Spanish:** Gavilán Malgache

Taxonomy. *Accipiter Madagascariensis* A. Smith, 1834, Madagascar.

Forms superspecies with *A. nisus*, *A. rufiventris* and perhaps the *A. striatus* complex. Monotypic.



Distribution. Madagascar.

Descriptive notes. 29-40 cm. Dark greyish brown upperparts and brown underparts barred white are darker than sympatric congeners. Recalls *A. nisus*, but generally much darker, lacking any rufous tones. Female much larger, browner and more heavily barred than male. Juvenile brown with dark streaks on underparts.

Habitat. Primary rain forest and dry thorn forest or scrub. Rarely in secondary habitats.

Food and Feeding. Small birds, insects taken in flight and some frogs and crickets. Long slender legs and toes suggest mainly avian prey.

Breeding. Laying Nov. Builds a stick nest high in a forest tree. One clutch of 3 eggs; no further details recorded.

Movements. None recorded.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Status poorly known. Uncommon in all areas and rare on deforested central plateau. Not commonly sighted and confined to primary habitats, many of which in Madagascar have already been seriously damaged, or are currently in process of being degraded.

Bibliography. Brown & Amadon (1968), Dee (1986), Langrand (1990), Langrand & Meyburg (1984), Milon *et al.* (1973), Watel (1973).

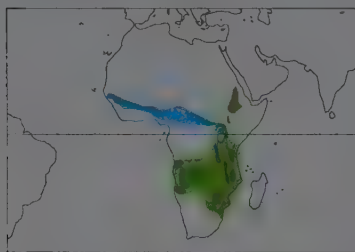
129. Ovambo Sparrowhawk

Accipiter ovampensis

French: Épervier de l'Ovampo **German:** Ovambosperber **Spanish:** Gavilán del Ovampo
Other common names: Ovampo Sparrowhawk

Taxonomy. *Accipiter ovampensis* Gurney, 1875, Okavango River, Ovamboland, Namibia. May belong in the *A. nisus* superspecies, but relationships uncertain. Monotypic.

Distribution. Senegambia, Sierra Leone and Ghana E to Ethiopia and S to Angola, N Namibia, N Botswana and N South Africa.



Descriptive notes. 30-40 cm; 119-305 g; wingspan 67 cm. Underparts barred up to throat, small snaky head, dark red eye and orange-red legs and cere notable. A rare melanistic morph also occurs, with birds all black at all ages. Most like smaller *Micronisus gabar* in all morphs, but lacks white rump (some white in uppart-coverts) and latter has red legs. Female much larger than male. Juvenile has two colour morphs, one brown, one rufous, but both with pale stripe above eye; rufous juvenile similar to *A. rufiventris*, but with dark eye.

Habitat. Edges of forest, woodland and exotic

plantations, moving into surrounding savanna and grassland when hunting.

Food and Feeding. Small birds of 10-60 g, although female takes doves of up to 250 g. Hunts mainly on the wing with fast coursing over the canopy or by stooping from high soaring flight. Also makes fast persistent chases from a high perch. Rather falcon-like in most aspects of hunting behaviour, with relatively long wings and shortish legs for a sparrowhawk.

Breeding. Laying May, Sept in Kenya; Aug-Nov in S Africa. Builds a nest of fine sticks lined with twigs, bark and leaves, high in a fork of a tall tree. Often sited on edge of forest, woodland or exotic plantation. Usually 3 eggs (1-5); incubation 33-35 days; chicks have white down; fledging c. 33 days.

Movements. Resident in S Africa but generally a secretive species. Thought to enter some marginal areas in E Africa only temporarily, probably from C African woodlands; to some extent nomadic in E Africa. Possibly only a non-breeding migrant during the wet season (Jun-Oct) to W Africa, where has been recorded W to Sierra Leone and Senegambia.

Status and Conservation. Not globally threatened. CITES II. Widespread and locally common in S and C African woodlands and plantations. Apparently uncommon in E and W Africa, but status uncertain, as species is easily overlooked. Vulnerable to cutting of woodland, but has extended range using small exotic plantations on savanna-grassland ecotone in South Africa, where densities of 1 pair/30-350 km² recorded. Not known to be affected by pesticides.

Bibliography. Allan & Hustler (1984), Benson & Benson (1975), Black & Ross (1970), Brown, L.H. (1970b), Brown *et al.* (1982), Craib (1983), Ginn *et al.* (1989), Grimes (1987), Irwin *et al.* (1982), Kemp & Crowe (1994a), Kemp & Kemp (1975c), Lewis & Pomeroy (1989), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Pickford *et al.* (1989), Pinto (1983), Simmons (1986a), Steyn (1982), Tarboton & Allan (1984), Thiollay (1978c, 1985d), Watel (1973).

130. Eurasian Sparrowhawk

Accipiter nisus

French: Épervier d'Europe **German:** Sperber **Spanish:** Gavilán Común

Taxonomy. *Falco Nisus* Linnaeus, 1758, Sweden.

Sometimes considered to include *A. rufiventris*. Forms superspecies with *A. madagascariensis*, *A. rufiventris* and perhaps the *A. striatus* complex. Birds from mountains of C Asia (Tien Shan) sometimes separated in race *dementjevi*; many other dubious races described. Six subspecies currently recognized.

Subspecies and Distribution.

A. n. nisus (Linnaeus, 1758) - Europe and Asia Minor E to W Siberia; winters S to NE Africa and Middle East.

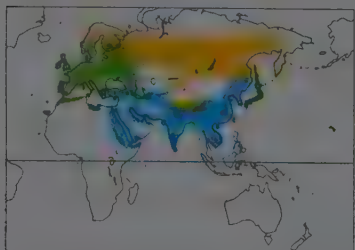
A. n. nisusimilis (Tickell, 1833) - C & E Asia; winters S to India, Sri Lanka and Indochina.

A. n. melaschistos Hume, 1869 - Himalayas and mountains of C Asia.

A. n. wolterstorffi Kleinschmidt, 1901 - Corsica and Sardinia.

A. n. granti Sharpe, 1890 - Madeira and Canary Is.

A. n. puniceus Erlanger, 1897 - NW Africa, from Morocco to Tunisia.



Descriptive notes. 28-38 cm; male 110-196 g, female 185-342 g; wingspan 60-75 cm. Cheeks and flanks have reddish tinge; conspicuous pale supercilium; pale underparts barred rufous and brown. Female considerably larger; underparts white with grey bars. Juvenile similar to female, but browner above with rusty feather margins; broader barring on underparts. Geographical variation largely clinal: races separated on size, coloration and density of barring.

Habitat. Forests, including coniferous, deciduous and mixed; also more open woodland; not unusual in urban parks. From sea-level to

mountains, in summer up to tree-line, foraging above it. Particularly favours mosaic of woodland or groves with more open areas. More catholic in winter, sometimes occurring in areas with very few trees.

Food and Feeding. Almost exclusively small and medium-sized birds, with predominance of former; prey rarely over 120 g. Enormous variety of species taken; more conspicuous prey types predominate, e.g. those that forage on ground. Commonest prey in Europe includes finches, especially Chaffinch (*Fringilla coelebs*), sparrows, buntings, tits, Tree Pipit (*Anthus trivialis*) and larks; larger birds commonly taken include thrushes and starlings; much more occasionally pigeons, jays and gamebirds. Takes many fledglings and nestlings; breeding season timed to coincide with period of maximum availability of young of prey species. Small mammals, particularly voles and other rodents, of very limited importance, as are young hares and rabbits, shrews and bats; also some insects. Tends to hunt in clearings, on edges of woods or in sparsely wooded areas; males hunt in more densely wooded areas than females, and catch smaller prey on average. Hunts stealthily, trying to surprise prey; often flies using vegetation for cover, or makes short flights between concealed perches.

Breeding. Laying Apr-Jun, varying with latitude. Nests in woods, preferably coniferous or mixed; often near clearing to ease access to nest. Nest built in tree, in lower crown, in fork or on branch; new nest built each year by both adults; platform of sticks with little or no greenery. Normally 3-6 eggs (1-7); replacement laying can occur twice in same season; incubation c. 32-34 days per egg, by female; chicks fed by female, but prey caught exclusively by male at least until mid-nesting period; chicks have first and second down white; fledging c. 26 days for males, c. 30 days for females; young fed for 3-4 weeks more. Breeding success variable, with marked decline historically following pollution by pesticides; in W Germany before 1950's c. 80% of nests produced chicks, in 1960's and 1970's only 54%; in Scotland in 1971-1984, average 2.3 chicks fledged per breeding pair, 3.4 per successful pair; up to 5 chicks fledge. Sexual maturity at 1-3 years. Rarely lives beyond 7 years; oldest recorded bird over 15 years old.

Movements. Migratory in northernmost parts of Europe and in most of Asia; partially migratory in C Europe; sedentary in S of range. Various C European countries receive N migrants, some of their breeding birds possibly migrating further S, reaching Mediterranean countries; most migration actually from NE to SW. Few migrants reach Africa, although some birds winter in N Africa and sub-Saharan Africa, occasionally S to Kenya and Tanzania. Siberian population winters in S & SE Asia.

Status and Conservation. Not globally threatened. CITES II. Declined drastically in Europe during 1950's and 1960's, due to generalized use of organochlorine pesticides, which killed adults and lowered breeding success. Gradual recovery since these pesticides banned in 1960's or 1970's (varying with country); recovery apparent in increased density and recolonizations, and also in numbers of migrants counted. No figures available for total population, only partial and approximate estimates. In 1980's probably over 100,000 pairs in Europe, excluding former USSR, including c. 25,000 pairs in Britain, 10,000-20,000 pairs in France, c. 14,000 pairs in Sweden, c. 10,000 pairs in Finland, 3500-5000 pairs in Denmark and c. 2500 pairs in Czechoslovakia; in early 1990's, c. 4500 pairs in Austria, 8500-10,000 pairs in Byelorussia, and possibly 160,000 pairs in European Russia. In 1980's, 200-500 pairs of race *wolterstorffi* in Corsica, 500-1000 pairs of *puniceus* in Morocco, and at least 175 pairs of *granti* in Canary Is. Heavily persecuted in 20th century by gamekeepers and hunters, with bounties regularly paid in several parts of Europe (see page 92); huge numbers killed. In Turkey, thousands captured by falconers each year and used for hunting migrating quails. Direct persecution now fairly limited in much of range and populations generally stable or increasing; more affected by reduction in prey availability and habitat alteration.

Bibliography. Ali & Ripley (1978), Bergier (1987), van Beusekom (1972), Brazil (1991), Brown *et al.* (1982), Cooke (1979), Cramp & Simmons (1980), Delgado *et al.* (1988), Dementiev & Gladkov (1951), Etchecopar & Hue (1978), Flint *et al.* (1984), Frumkin (1988b), Geer (1978), Gönşöl (1986), Glutz von Blotzheim *et al.* (1971), Goodman *et al.* (1989), Handrinos & Demetropoulos (1983), Holstein (1950), Hou *et al.* (1990), Jencour (1986), Kjellen (1992), Kramer (1955), Mackworth-Præd & Grant (1962), Marchant (1980), Marquiss (1980), Marquiss & Newton (1982a), Möller (1977), Moritz & Vauk (1976), Moss (1979), Newton (1976, 1978, 1985b, 1986, 1988, 1991), Newton & Haas (1984), Newton & Marquiss (1976, 1979, 1981, 1982a, 1982b, 1982c, 1982d, 1983, 1984, 1986, 1991), Newton & Moss (1986), Newton, Bell & Wyllie (1981), Newton, Marquiss & Moss (1979, 1981), Newton, Marquiss & Rothery (1983), Newton, Marquiss & Village (1983), Opdam *et al.* (1987), Ordlieb (1981), Owen (1916, 1926-1927, 1931-1932a, 1931-1932b, 1932-1933), Paction (1989), Palmer (1988), Patrimonio (1987), Paz (1987), Popov & Verzhutskii (1990), Rasmussen & Storgård (1989), Roberts (1991), Rogacheva (1992), Saurala (1981), Shirihai & Christie (1992), Simeonov *et al.* (1990), Sulkava (1964b), Tinbergen (1946), Young, J.G. (1973), Watel (1973), Wyllie (1985), Wyllie & Newton (1991).

131. Rufous-breasted Sparrowhawk

Accipiter rufiventris

French: Épervier menu **German:** Rotbauchspërber **Spanish:** Gavilán Papirufu
Other common names: Red-breasted/Rufous-chested/Rufous Sparrowhawk

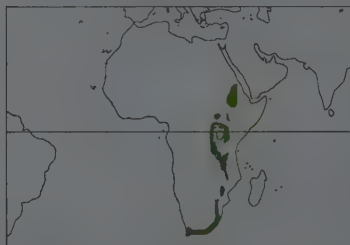
Taxonomy. *Accipiter rufiventris* A. Smith, 1830, South Africa.

Forms superspecies with *A. nisus* (with which often considered conspecific), *A. madagascariensis* and perhaps the *A. striatus* complex. Two subspecies recognized.

Subspecies and Distribution.

A. r. perspicillaris (Rüppell, 1836) - Ethiopian highlands.

A. r. rufiventris A. Smith, 1830 - Kenya and E Zaire S to South Africa.



Descriptive notes. 33-40 cm; 180-210 g; wingspan 72 cm. Yellow eye distinctive at all ages. Female much larger than male. Juvenile with fine white bars on rufous underparts, similar to rufous morph of juvenile *A. ovampensis*. Race *perspicillaris* considerably larger and also darker.

Habitat. Patches of montane forest and exotic pine, eucalypt and poplar plantations; hunts over adjacent savanna, grassland and fynbos. Occurs down to sea-level and in suburbia in S South Africa, extending into arid karoid steppe by use of exotic plantations.

Food and Feeding. Mainly birds of 10-90 g, up to size of pigeons, together with some bats, rodents, lizards and a few insects. Hunts from a perch within cover, or more often from low coursing flight, making a fast dash in pursuit of prey, which is taken in flight or forced to the ground or into cover. Sometimes hunts by stooping from soaring flight, and regularly hunts over open ground near woodland.

Breeding. Laying Jul in Uganda; Sept-Dec in S Africa. Builds a platform of small sticks lined with leaves, bark and moss, in the upper fork of a tree. Usually 3 eggs (2-4); incubation 34 days; chicks have white down; fledging 31-36 days; post-fledging dependence 22-41 days.

Movements. May make some altitudinal movements down from montane forest during winter, as in some high-lying areas of S Africa, but apparently resident in most forest patches.

Status and Conservation. Not globally threatened. CITES II. Locally common, as at density of 1 pair/23-33 km² in Transvaal, South Africa. Vulnerable to degradation of small indigenous forest patches and cutting of montane timber, but readily adopts exotic plantations and is common in suburban Cape Town. Not known to be affected by pesticides.

Bibliography. Benson & Benson (1975), Black & Ross (1970), Brown *et al.* (1982), Butynski & Kalina (1988), Ginn *et al.* (1989), Grobler (1981), Irwin *et al.* (1982), Macdonald (1986), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Pickford *et al.* (1989), Pinto (1983), Simmons (1984, 1986a, 1986b, 1986c), Steyn (1982, 1988), Tarboton & Allan (1984), Thiollay (1978c), Wattel (1973), van Zyl & Cooke (1987).

132. Sharp-shinned Hawk

Accipiter striatus

French: Épervier brun **German:** Eekschwanzspërber **Spanish:** Gavilán Americano
Other common names: Sharpshin, Sharpie, Little Blue Darter

Taxonomy. *Accipiter striatus* Vieillot, 1807. Santo Domingo, Hispaniola.

Forms superspecies with *A. chionogaster*, *A. ventralis* and *A. erythronemius*, all of which have traditionally been included within present species, but differ on morphology, ecology and probably behaviour. Also close to *A. nisus* and associated species. Seven subspecies recognized.

Subspecies and Distribution.

A. s. perobscurus Snyder, 1938 - Queen Charlotte Is; possibly also mainland coast of British Columbia.

A. s. velox (Wilson, 1812) - Alaska and Canada S to California, Arizona, New Mexico and Alabama (USA); winters S to Panama.

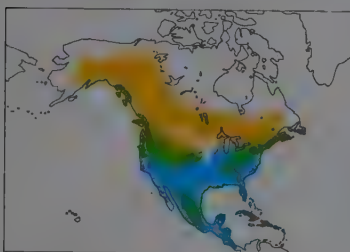
A. s. suttoni van Rossem, 1939 - extreme S New Mexico (USA) S locally to Veracruz (Mexico).

A. s. madrensis Storer, 1952 - Guerrero and perhaps W Oaxaca (S Mexico).

A. s. striatus Vieillot, 1807 - Hispaniola, in both Haiti and Dominican Republic.

A. s. fringilloides Vigors, 1827 - Cuba.

A. s. venator Wetmore, 1914 - Puerto Rico.



Descriptive notes. 25-34 cm; male 82-125 g, female 144-208 g; wingspan 51-69 cm. A typical small short-winged, long-tailed forest hawk. Bluish upperparts; underparts rufous to tawny buff, with extent of barring variable; broad grey bars in tail; eye red. Female much larger than male. Juvenile dark brown above with pale streaked underparts; eye yellow. Races vary in coloration, extent of barring on underparts, especially thighs, and size.

Habitat. Wide variety of habitats, depending on region. Boreal coniferous forests, brushy areas or mixed open deciduous woodlands in N; pine forests on mountain slopes, tropical

and subtropical cloud forest, savanna woodland and gallery forest in S of range. Seldom seen above canopy. Shows some preference to be close to water. Almost any terrain in non-breeding season; frequent in treed urban areas of North America.

Food and Feeding. Highly specialized catcher of birds, which constitute c. 90% of prey. Most prey of 15-27 g. Other food includes small mammals, frogs, lizards and insects. Hunts by fast bursts of speed along woodland routes, or by still-hunting attacks. Prey typically plucked at "butcher-blocks", or plucking posts, not too distant from nest.

Breeding. Apr-Jul in North America, Jan-Jul in Caribbean. Solitary. Nests typically in small stand of conifers with dense foliage; also uses oaks, maples, aspens; nest is bulky platform c. 50 cm wide, 20 cm deep, placed c. 4-11 m from ground; lined with bark or greenery. 4-5 eggs in North America, 2-3 in Caribbean; incubation 30-32 days (N America); chicks have white down; move out of nest at 21-27 days, but feathering fully developed at 38-40 days. May breed (especially females) in 1st full year, in juvenile plumage; occasionally pairs of juveniles occur. Oldest ringed bird c. 7 years. Nest success of c. 60-100% (North America) and 29% (Caribbean) per attempt; hatching success c. 63-85% of eggs laid; c. 2-7-3-5 (North America) and 0-8 (Caribbean) young fledged per attempt.

Movements. Race *velox* migratory, especially from taiga, moving S to Panama; most other races seemingly resident; dark individuals, similar to *perobscurus*, found outside breeding range suggesting that this race may wander. Juvenile females of *velox* start autumn migration in late Aug. before young males or adults; migration ends by late Oct. Spring migration Mar-Jun, depending on latitude. Winter movement occurs from high to lower altitudes.

Status and Conservation. Not globally threatened. CITES II. Race *velox* affected by organochlorine chemicals in 1960's and 1970's; some general declines. Habitat alteration, especially removal of forest, continues to affect populations, although species capable of adapting to urban areas. Migration data suggest *velox* increasing (1980's-1990's). No reliable data on numbers of any population, but races *venator* and *fringilloides* reportedly rare; total population of former estimated at 155 individuals remaining in five forests, and this race currently proposed for listing as endangered.

Bibliography. Buxley (1930), Clark, W.S. (1984), Cruz & Dickinson (1983), Delannay (1982), Delannay & Cruz (1988), Duncan (1980), Evans & Rosenfield (1985), Fischer, D.L. (1984, 1986), Friedmann (1950), Garrido (1985), Harwood (1975), Hennessey (1978), Holthuijzen *et al.* (1985), Johnsgard (1990), King (1978/79), Moore & Henny (1983), Mueller & Berger (1967a), Mueller *et al.* (1979a, 1981), Murray (1964), Noble & Elliott (1990), Palmer (1988), Platt (1976c), Reynolds & Meslow (1984), Reynolds *et al.* (1982), Ridgely & Gwynne (1989), Slud (1964), Snyder & Wiley (1976), Snyder *et al.* (1973), Smith *et al.* (1990), Storer (1952, 1966), Swann (1922), Wattel (1973), Wetmore (1965).

133. White-breasted Hawk

Accipiter chionogaster

French: Épervier à poitrine blanche **German:** Weißbrustspërber **Spanish:** Gavilán Ventri blanco

Taxonomy. *Nisus* (*Accipiter*) *chionogaster* Kaup, 1852. Cobán, Guatemala.

Often considered race of *A. striatus*, or alternatively of *A. erythronemius*, forming superspecies with these two and *A. ventralis*; group split on grounds of differences in morphology, ecology and probably also behaviour. Monotypic.

Distribution. Highlands of Central America, from S Mexico (Chiapas, Oaxaca) through Guatemala, Honduras and El Salvador to NC Nicaragua.

Descriptive notes. c. 30 cm. Uniform dark grey above, white below with fine blackish streaks on feather shafts of crown, throat and upper breast; thighs show hint of pale rufous; tail dark with broad



grey bands. Smaller and generally paler below than *A. bicolor*. Iris red or orange. Female similar, but larger. Immature has more extensive, browner and broader vertical streaking below.

Habitat. Pine forests or mixed pine and oak forests up to temperate zone; also in cloud forest, montane rain forest and semi-open areas. Usually above 600 m, and up to at least 1080 m; rarely down to sea-level.

Food and Feeding. No information available; presumably feeds extensively on birds, as do close relatives.

Breeding. No information available; presumably uses stick nests in tall trees.

Movements. No information available.

Status and Conservation. Not globally threatened. CITES II. Status uncertain; relatively restricted range and extensive deforestation within this range suggest that careful monitoring is merited.

Bibliography. Blake (1977), Brown & Amadon (1968), Land (1970), Monroe (1968), Ridgely & Gwynne (1989), Siles & Skutch (1989), Wattel (1973), Wetmore (1941).

134. Plain-breasted Hawk

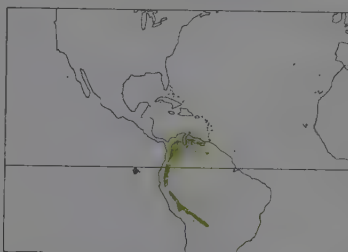
Accipiter ventralis

French: Autour à gorge rayée **German:** Andenspërber **Spanish:** Gavilán Andino

Taxonomy. *Accipiter ventralis* P. L. Selater 1866. Bogotá, Colombia.

Often considered race of *A. striatus*, or alternatively of *A. erythronemius*, forming superspecies with these two and *A. chionogaster*; group split on grounds of differences in morphology, ecology and probably also behaviour. Monotypic.

Distribution. Hills and mountains from N & SE Venezuela and Colombia through Ecuador and Peru to W Bolivia (Cochabamba).



Descriptive notes. 28-33 cm. Dark grey above; tail with 3-4 thin grey bands; thighs deep rufous to reddish chestnut brown. Polymorphic: underparts usually cinnamon rufous, barred and spotted white, throat whitish with very fine dark streaking; pale forms have underparts almost completely white, with some faint dark streaking or barring and red thighs; melanistic morph slate grey with rufous belly and thighs. Female similar, but larger. Immature streaky dark brown above, white with dark brown streaks below, and characteristic rufous thighs.

Habitat. Forested mountain slopes from upper tropical to temperate zone, often at forest edge, in woodlots, and in brushy second growth. Normally at 900-2700 m, but regularly down to 300 m in Venezuela and also sighted at 3540 m in Peru.

Food and Feeding. Little known, but reported to chase birds from a concealed perch, as do closely related species.

Breeding. One female in breeding condition collected in Colombia in Jun. Nest undescribed, but presumably stick nest in tall trees.

Movements. No information available.

Status and Conservation. Not globally threatened. CITES II. Currently fairly common in parts of range; propensity to use second growth suggests no grounds for immediate concern.

Bibliography. Blake (1977), Brown & Amadon (1968), Cabot & Serrano (1986), Fjeldsa & Krabbe (1990), Hilty & Brown (1986), Meyer de Schauensee & Phelps (1978), Parker *et al.* (1982), Reimsen & T aylor (1989).

135. Rufous-thighed Hawk

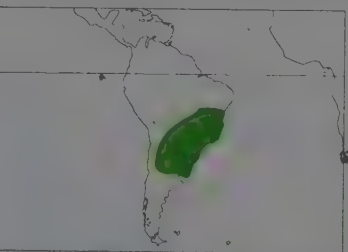
Accipiter erythronemius

French: Épervier à cuisses rousses **German:** Rotschenkelspërber **Spanish:** Gavilán Muslirrufo

Taxonomy. *Nisus* vel *Accipiter erythronemius* Kaup (ex G. R. Gray MS), 1850. Bolivia.

Often considered race of *A. striatus*, with which forms superspecies, along with *A. chionogaster* and *A. ventralis*; group split on grounds of differences in morphology, ecology and probably also behaviour. Monotypic.

Distribution. S Brazil (S from Mato Grosso and Bahia) to Uruguay, and SE Bolivia (Santa Cruz to Tarija) through Chaco of Paraguay to N Argentina (La Rioja & Córdoba).



Descriptive notes. 30 cm. Similar to normal morph of closely related *A. ventralis*; above uniform slate black to fuscous brown, below barring (when present) more conspicuous; thighs and middle of flanks uniformly rusty; grey and black tail bars of equal width. Female similar, but noticeably larger than male. Immature has wings and back brown, below white with brownish streaking.

Habitat. Generally rather arid forests, woodland and semi-open areas such as wooded savannas.

Food and Feeding. Little known but probably mostly birds.

Breeding. Nest undescribed, but presumably stick nest in tall trees, as with closely related species.

Movements. No information available.

Status and Conservation. Not globally threatened. CITES II. In general fairly common, but locally threatened where extensive monocultural agriculture removes all stands of woodland; otherwise probably fairly adaptable and no apparent grounds for concern.

Bibliography. Benson (1984), Blake (1977), Courcier *et al.* (1990), Ginn & Ginn (1978), Janssens & Kruze (1990), Kinnaird & Moschione (1987), Navas & Bo (1991), de la Peña (1992), Pino (1964), Reimsen & T aylor (1989), Ruschi (1979), Sick (1985a, 1993).



136. Cooper's Hawk

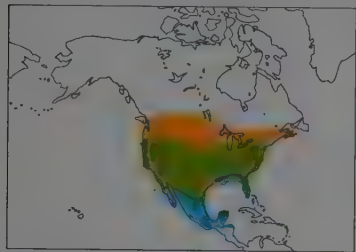
Accipiter cooperii

French: Épervier de Cooper **German:** Rundschwanzspërber **Spanish:** Gavilán de Cooper
Other common names: Big Blue Darter, Chicken Hawk

Taxonomy. *Falco cooperii* Bonaparte, 1828, Bordentown, New Jersey.

Forms superspecies with *A. gundlachi*, *A. bicolor* and *A. chilensis*. Monotypic.

Distribution. USA and S Canada. Winters from N USA to C America, regularly as far S as Honduras, occasionally to Colombia.



Descriptive notes. 37-49 cm; male 235-300 g, female 413-598 g; wingspan 90-99 cm. Smallish long-tailed forest hawk, with rounded wings; eye red. Bluish upperparts and rufous barred underparts; essentially a larger version of *A. striatus*. Female much larger than male. Juvenile brown with streaked underparts; eye yellow.

Habitat. Forests with dense canopy cover; fairly equal use of coniferous and deciduous forests, with preference apparently depending on dominant species. Riparian communities heavily used in arid regions. Tends to use forest edge and clearings. In winter, all habi-

tats, even urban. Has also bred in urban areas.

Food and Feeding. Proportion of mammals to birds varies regionally; birds appear favoured overall (60-80%), but shares can be c. 50:50; also takes some reptiles. Prey normally 36-51 g, c. 12% of adult weight. Hunting by extended flights along forest edge or naturally cleared routes, and by still-hunting from perch. Hunting success may be 50% for mammals, 20% for birds.

Breeding. Mar-Jul; probably slightly earlier at S limits, e.g. Texas and N Mexico. Solitary. Nest is compact platform of sticks, broad and flat; tends to be smaller (c. 64-76 cm wide, 15-20 cm deep) in conifer than in deciduous tree (c. 43 cm deep); lined with bark, leaves or other greenery. Nest tree often near stream, other water or forest opening; c. 8-16 m above ground; usually in main crotch or horizontal limb against trunk; nest tree varies regionally from c. 90% conifer use to c. 90% deciduous (e.g. aspen) use. Usually 3-6, commonly 4-5 eggs; incubation 30-34 days; chicks have white down; fledging 27-30 days. Will breed in immature plumage at 1 year (usually females), but normally at 2 years. Longevity record 8 years, but believed to live longer; annual mortality rate c. 60-70%. Nest success c. 70-81% of attempts; fledging success c. 53-69% of eggs laid; 1.9-3.2 young fledged per attempt, depending somewhat on age of female, or region.

Movements. Generally migratory from N half of range, but some birds remain even at N part of range. Sedentary elsewhere, though birds at high altitudes may move to lowlands. In autumn, yearlings migrate first, and females precede males in each age category; migration late Aug-early Nov, with peak from mid-Sept to mid-Oct. In spring, males precede females. Mar-May. Migrates commonly to Mexico, but as far as Costa Rica and rarely Colombia.

Status and Conservation. Not globally threatened. CITES II. Widespread and common; perhaps one of commonest hawks in W USA. Seriously affected by organochlorines in 1940's and 1950's, with calculated annual rate of population decline of 25% in E, after 1948. Less severely affected in W, but pre-1945 fledging rate of 3-53 declined to 2-67 during period of pesticide usage (1949-1967). Significant correlation between percentage of birds in diet and DDE content found in eggs. Greatest decrease in eggshell thickness was 19%; 15-17% eggshell decrease produced serious reproductive difficulty. Migration counts in 1993 indicate species on increase.

Bibliography. Bielefeldt & Cary (1991), Bielefeldt *et al.* (1992), Blake (1977), Evans (1982), Hennessey (1978), Henry & Wight (1972), Hoffman, S.W. *et al.* (1992), Johnsgard (1990), Jones, S. (1979), Kennedy & Johnson (1986), Kratz (1989), Meng (1959), Millsap (1981a), Moore & Henry (1983), Mosher (1989), Mueller *et al.* (1979b), Murphy *et al.* (1988), Palmer (1988), Reynolds (1989), Rosenfield (1990), Rosenfield & Bielefeldt (1993), Rosenfield *et al.* (1991), Slud (1964), Smith *et al.* (1990), Snyder & Snyder (1979), Snyder & Wiley (1976), Snyder *et al.* (1973), Stahlacker & Beach (1979), Titus & Mosher (1981), Toland (1985a), Wattel (1973), Whaley & White (1994), Wiggers & Kratz (1991).

137. Gundlach's Hawk

Accipiter gundlachi

French: Épervier de Cuba **German:** Gundlachsperber **Spanish:** Gavilán Cubano

Taxonomy. *Accipiter Gundlachi* Lawrence, 1860, Hanábara, Cuba.

Closely related to *A. cooperii*, *A. bicolor* and *A. chilensis*, forming superspecies with all three; at present no indications as to which of first two species is ancestral to present species. Two subspecies recognized.

Subspecies and Distribution.

A. g. gundlachi Lawrence, 1860 - W & C Cuba.

A. g. wileyi Wotzkow, 1991 - E Cuba.



Descriptive notes. 42-50 cm. Intermediate in plumage between *A. cooperii* and *A. bicolor*, differing from former in grey breast, from latter in grey and rufous barring on belly and thighs. Dark grey above; tail broadly banded light and dark grey; blackish grey cap contrasts with largely pale bill; greyish white flanks and undertail-coverts conspicuous against darker fine grey barring on rufous brown thighs and belly. Female averages slightly larger, with longer tail. Immature brown above, with brown streaking below, and spotting on underwing. Recently described race *wileyi* differs principally in

underpart coloration of immature.

Habitat. Not specialized; populations of W and C nest in low sub-montane (under 800 m) evergreen forest, and also in semi-deciduous marshy forest, at forest edge, and along forested coastline;

E race nests in better developed forests, and also pine forest, cloud, riverine, and dry evergreen microphyllous forests, as well as tropical rain forest. An upland nest was found at 780 m in a dense stand of pines.

Food and Feeding. Little information available; items recorded include parrots, pigeons and doves, crows, nighthawks, Northern Bobwhite (*Colinus virginianus*), Red-legged Thrush (*Turdus plumbeus*) and domestic fowl; these, together with large feet and long toes, suggest that species specializes on avian prey. Females appear to take larger and more conspicuous prey in or above the canopy, while males capture smaller prey in the understorey.

Breeding. Poorly known, but data is accumulating: several nests reported at or around swamp of Ciénaga de Zapata in W Cuba. Nest building Jan-Apr, with young fledged by Jun. Stick nest built 7-20 m up tree; birds will reuse same nest for at least 3 years, and presumably more. Normally 3-4 eggs, once 2. No further information available.

Movements. Sedentary.

Status and Conservation. VULNERABLE/RARE. CITES II. Total numbers estimated at c. 150-200 pairs, mostly in E Cuba, but with three additional populations in W, in provinces of Las Villas, Matanzas (Zapata Swamp) and Pinar. Some populations occur within protected areas, but recent recognition of subspecifically distinct E population argues for further inventories. Although apparently never common, formerly much more widely distributed on the island. Human persecution aggravated by the fact that species is known to take poultry; this and loss and disturbance of wooded habitats seem to be principal threats. Recently more woodland being cut as consequence of fuel shortage in Cuba. There are records of young birds taken for captivity, or for international raptor trade.

Bibliography. Abreu *et al.* (1989), Balat & González (1982), Bond (1979), Collar (1986a), Collar & Andrew (1988), Collar *et al.* (1992), Garrido (1985), Garrido & Montaña (1975), Gundlach (1871-1875), Meyburg (1986), Rams & Pena (1988), Reynard *et al.* (1987), Torres *et al.* (1988), Wattel (1973), Wiley (1985, 1986), Wotzkow (1985, 1986b, 1991).

138. Bicoloured Hawk

Accipiter bicolor

French: Épervier bicoloré **German:** Zweifarbensperber **Spanish:** Gavilán Bicolor
Other common names: Spotted Hawk (*guttifer*)

Taxonomy. *Sparvius bicolor* Vieillot, 1817, Cayenne.

Normally considered to include *A. chilensis* as a race, but differs in ecology, especially in habitat preferences; also closely related to *A. cooperii* and *A. gundlachi*, and these four form a superspecies. Race *guttifer* has been considered full species; alternatively a race of *A. chilensis*, but isolated range of *A. chilensis* and intergradation of *guttifer* with *A. b. pileatus* suggest *guttifer* closer to *A. bicolor*. Race *schistochlamys* of W Ecuador incorporated in nominate. Four subspecies currently recognized.

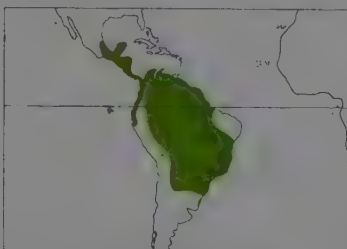
Subspecies and Distribution.

A. b. fidens Bangs & Noble, 1918 - S Mexico, N of Yucatán, in Oaxaca and Veracruz.

A. b. bicolor (Vieillot, 1817) - S Mexico (Yucatán) to Amazonia and the Guianas, S to E Bolivia, and W of Andes S to NW Peru (Lambayeque).

A. b. pileatus (Temminck, 1823) - Brazil S of Amazonia (E Mato Grosso to S Maranhão and Ceará) and S to NE Argentina (Misiones).

A. b. guttifer Hellmayr, 1917 - Brazil (W Mato Grosso) and Bolivia through Chaco of Paraguay to N Argentina.



Descriptive notes. 30-42 cm; wingspan 65-80 cm. Considerable variation in plumage. Dark slate grey above, with or without pearl grey collar; below pale to dark grey to rufous, with conspicuous bright rufous thighs; tail with 2-4 narrow whitish to greyish bars. Cere and legs yellow, iris orange. Resembles *Harpagus diodon* in both adult and immature plumages, especially of race *pileatus*, but quite different structure; likeness may be result of protective mimicry by *H. diodon*. Female noticeably larger. Immature blackish to blackish brown above, with paler scalloping; more or less conspicuous whitish or buffy collar; below white

to buff, occasionally deep rufous; thighs darker, sometimes mottled. Races separated on coloration of underparts, and also on size; race *guttifer* grey on upper throat and rich rufous below, mottled with white or grey.

Habitat. Not specialized: rain forest in the Guianas; elsewhere more common in drier, open or thinned forest; also palm savanna with gallery forest and scattered forest patches, and second growth; cerrado in SW Brazil. Up to 2000 m in Colombia. Soars over the forest.

Food and Feeding. A specialist on avian prey. Of 91 prey items recorded in Petén, Guatemala, 68% were birds; 6% mammals and reptiles; the rest unidentified, most of these probably small birds. Elsewhere predilection for avian prey maintained, with doves and thrush recorded. Still-hunts from perches in forest, or pursues birds through forest; sometimes hunts in pairs. Seen attacking troops of squirrel monkeys (*Saimiri*) and tamarins (*Saguinus*); but also following troop of capuchins (*Cebus*), feeding on insects flushed by the monkeys.

Breeding. Laying in Apr-May (mid to late dry season) in Petén; in rainy season in Venezuela. Stick nest in tall tree, often near forest edge; nest c. 30-40 cm wide. 1-3 eggs in Petén; possibly 4 in S of range; incubation 33-37 days; fledging 30-36 days; young remain near nest being fed by parents for at least 60 days after fledging. At one site in Petén, 67% hatch rate, with 92% of hatched young fledging. Male and female defend area of 30 m around nest from other birds, both raptors and large passerines; one adult male had home range of 440 ha during nesting period.

Movements. No evidence of movements.

Status and Conservation. Not globally threatened. CITES II. Widespread, but generally rare. Estimated average density of at least 4 individuals/10,000 ha at one French Guiana forest site. In Petén, average distance between nests was 3.1 km.

Bibliography. Amadón (1961b, 1964), Belton (1984), Blake (1977), Contreras *et al.* (1990), Feltus & Krabbe (1990), Hilty & Brown (1986), Jakse & Juarez (1985), Mader (1985), Meyer de Schauensee & Capen (1958), Monks (1968), Ojeda (1985), de la Peña (1992), Pimentel (1994), Quisenberry *et al.* (1991), Rams & A. Drake (1989), Rusch (1979), Sick (1985a, 1993), Slud (1964), Tello (1983), Thallus (1989a, 1989b, 1991a), Thorstrom, Castillo & Castillo (1991), Trail (1987), Wattel (1973), Wetmore (1965).

139. Chilean Hawk

Accipiter chilensis

French: Épervier du Chili

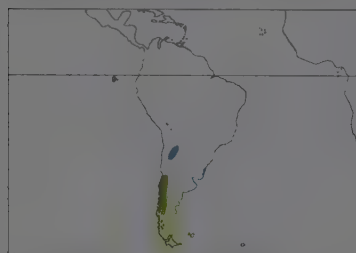
German: Chilesperber

Spanish: Gavilán Chileno

Taxonomy. *Accipiter chilensis* Philippi and Landbeck, 1864, Chile.

Forms superspecies with *A. bicolor*, *A. cooperii* and *A. gundlachi*. Often considered (mega)subspecies of *A. bicolor*, but isolated range with no geographical variation, and use of temperate forests, unlike *A. bicolor*, suggest treatment as full species is merited. Sometimes held to include *A. bicolor guttifer*. Monotypic.

Distribution. Andes of C Chile (O'Higgins) and adjacent Argentina S to Tierra del Fuego and Staten I. Winters N to NW Argentina (Catamarca).



Descriptive notes. c. 30–42 cm. Dark slate above; throat white, rest of underparts grey, brownish grey or salmon rufous, barred and flecked with white; thighs and underwing rufous. Generally darker above and paler below than *A. bicolor guttifer*. Female similar to male, but markedly larger. Immature creamy white below, with heavy dark brown streaking.

Habitat. Temperate wet forests, especially of Chilean oak (*Nothofagus obliqua*), but also *Araucaria*, usually intermixed with open areas; recorded in open scrub. From sea-level up to 1000 m.

Food and Feeding. Primarily birds; a bold and rapacious predator.

Breeding. Laying in Oct (austral spring). Nest of dead and green sticks and other material in tall tree, often near forest edge. 4 eggs. No further information available.

Movements. Part of population migrates to NW Argentina, perhaps following northbound migratory passerines. Limits of transition between migratory and resident populations not known.

Status and Conservation. Not globally threatened. CITES II. Status very poorly known. Reportedly declining in much of Chile, but said to be little influenced by moderate levels of forest clearing.

Bibliography. Blake (1977), Fjeldså & Krabbe (1990), Hellmayr (1932), Humphrey *et al.* (1970), Johnson (1965), Olrog (1949, 1985), de la Peña (1992), Vuilleumier (1985), Wattel (1973).

140. Black Sparrowhawk

Accipiter melanoleucus

French: Autour noir

German: Mohrenhabicht

Spanish: Azor Blanquinegro

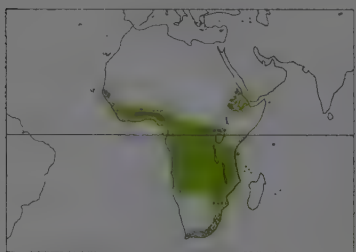
Other common names: Great Sparrowhawk, Black/Pied Goshawk, Black-and-white Sparrowhawk/Goshawk

Taxonomy. *Accipiter melanoleucus* [sic] A. Smith, 1830, South Africa.

May form superspecies with *A. gentilis*, *A. henstii* and even *A. meyerianus*. Two subspecies recognized.

Subspecies and Distribution.

A. m. temminckii (Hartlaub, 1855) - Senegambia E to Gabon, Congo and Central African Republic.
A. m. melanoleucus A. Smith, 1830 - E Sudan and N & W Ethiopia; Gabon and Zaire E to Kenya and S to Angola and South Africa; Pemba and Zanzibar.



Descriptive notes. 46–58 cm; male 430–490 g, female 650–980 g; wingspan 102 cm. Pied plumage of adult notable, with white breast in normal morph, or only white throat in melanistic morph (nominative race only). Similar to *Hieraaetus* and *Spizaeus* hawk-eagles, differing notably in unfeathered yellow legs and dark eye. Female much larger than male. Juvenile also with two morphs, underparts rufous or cream and streaked with dark brown; large (female) juveniles of *A. tachiro* are similar, but speckled or barred on underparts.

Habitat. All types of forest, dense woodland and exotic plantations, from tropical lowlands to high montane patches. Even occurs in and around cities, e.g. Yaoundé, Cameroon.

Food and Feeding. Mainly birds of 80–300 g, up to size of guineafowl, but especially doves, pigeons and francolins. Takes some small mammals and snakes, and also poultry if available. Hunts by fast dash from perch within cover, less often after fast coursing flight under cover of vegetation or low over ground, sometimes by fast stoop from high soaring flight. A bold predator, capable of prolonged tail chases after quarry that extend into secondary forest, savanna and grassland. May carry prey 12 km to nest, flying high above the canopy.

Breeding. Laying Aug–Nov in W Africa; Mar–Jun and Oct–Dec in Zaire and Kenya; May–Oct in S and C Africa (peak Sept–Oct). Builds large stick nest high in tall forest tree, especially attracted to eucalypt plantations; lines nest with sprays of green leaves; same site may be used repeatedly over successive seasons; rarely nests on ground at base of tree. 2–4 eggs; incubation 34–38 days; chicks have white down; fledging 37–47 days.

Movements. Resident and territorial in most areas. However, rapidly colonizes new plantations in grassland or savanna and may undertake long excursions across sea, lake or desert. Possibly even locally migratory in W and NE Africa.

Status and Conservation. Not globally threatened. CITES II. Widespread and common, but apparently at low density in extensive lowland rain forest tracts despite nest territory of only 250 ha. Among forest patches and savanna, occurs at densities of 1 pair/13 km² in Kenya, or 1 pair/38–150 km² in Transvaal, South Africa, where total of 800 pairs. Adapts well to various secondary forests and readily colonizes exotic plantations and subsistence farmland. Vulnerable to cutting of forest and deciduous woodlands; known to have high pesticide levels in some areas of N Africa, and to have suffered local extinctions in some unmanaged forests.

Bibliography. Benson & Benson (1975), Black & Ross (1970), Britton (1980), Brosset (1973, 1977), Brosset & Enard (1980), Brown & Brown (1979), Brown *et al.* (1982), Crabb (1983), Ginn *et al.* (1989), Grimes (1987), Hart (1977), Hartley (1976), Lewis & Pomeroy (1989), Mackworth-Praed & Grant (1957–1973), Maclean (1993), Pakenham (1979), Pickford *et al.* (1989), Pinto (1983), Simmons (1986a), Snelling *et al.* (1984), Steyn (1982), Tarboton & Allan (1984), Tarboton *et al.* (1978), Thiollay (1978c), Thomson (1991a)

141. Henst's Goshawk

Accipiter henstii

French: Autour de Henst

German: Madagaskarhabicht

Spanish: Azor Malgache

Other common names: Madagascar Goshawk

Taxonomy. *Astur henstii* Schlegel, 1873, Madagascar.

May form superspecies with *A. gentilis*, *A. melanoleucus* and even *A. meyerianus*. Monotypic.

Distribution. Madagascar.



Descriptive notes. 52–62 cm. Both sexes have upperparts brownish grey with underparts finely barred greyish brown and white; pale stripe above the eye distinctive. Remarkably similar to Eurasian *A. gentilis*, but eye yellow; also shows fairly similar colours and markings to rare sympatric *Eutriorchis astur*, but has white supercilium and rather different structure. Female larger than male. Juvenile with large brown spots on tan underparts.

Habitat. Primary rain forest of E and dry forest of W up to 1800 m; sometimes in secondary woodland.

Food and Feeding. Larger forest birds, some poultry and small mammals; suspected to take some lemur species. Spends long periods perched within cover; probably mainly perch-hunts, but also flies swiftly through forest. Rarely soars above canopy.

Breeding. Laying Oct–Nov. Large nest of sticks placed in main fork of large tree, even in an exotic eucalypt plantation. Adults noisy around nest. Chicks have white down; no further details recorded.

Movements. None recorded.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Known from forests of E and W coasts but not from drier S. Generally rare; only seen twice during 18 months of recent field work. Vulnerable to deforestation, and may deserve increased conservation attention.

Bibliography. Benson *et al.* (1976), Dee (1986), Langrand (1990), Langrand & Meyburg (1984), Milon *et al.* (1973), Wattel (1973).

142. Northern Goshawk

Accipiter gentilis

French: Autour des palombes

German: Habicht

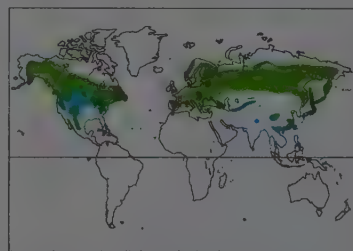
Spanish: Azor Común

Taxonomy. *Falco gentilis* Linnaeus, 1758, (Swedish) Alps.

May form superspecies with *A. melanoleucus*, *A. henstii* and even *A. meyerianus*. Internal taxonomy somewhat confused. American races may merit treatment as distinct species. Separate races have been awarded to birds from W & C Europe (*gallinarum*), Spain and N Africa (*kleinschmidtii*), SE Europe (*marginatus*), and SW USA and NW Mexico (*apache*), but of doubtful validity, as at least some of variation clinal; many other dubious races described. Eight subspecies currently recognized.

Subspecies and Distribution.

A. g. gentilis (Linnaeus, 1758) - Europe and extreme NW Africa.
A. g. arrigonii (Kleinschmidt, 1903) - Corsica and Sardinia.
A. g. buteoides (Menzies, 1882) - extreme NE Eurasia, from N Sweden E to R Lena; winters S to C Europe and C Asia.
A. g. albidus (Menzies, 1882) - NE Siberia to Kamchatka.
A. g. schvedowi (Menzies, 1882) - Asia, from Urals to Amurland, Sakhalin and Kuril Is, S to C China; winters S to Himalayas and N Indochina.
A. g. fujiyamae (Swann & Hartert, 1923) - Japan.
A. g. atricapillus (Wilson, 1812) - North America, S to Tennessee and S Arizona (USA) and Jalisco (W Mexico).
A. g. laingi (Taverner, 1940) - Queen Charlotte Is and Vancouver I, British Columbia (W Canada).



Descriptive notes. 48–68.5 cm; male 517–1170 g, female 820–1509 g; wingspan 96–127 cm. Conspicuous white supercilium. Differs from *A. henstii* in reddish orange iris, and generally weaker barring on underparts. Male larger and stockier than female of *A. nisus*; less heavily barred below; tail proportionally shorter, not square-ended. Female considerably larger than male; browner grey above; iris yellowish orange. Juvenile brown above, pale buff to whitish and streaked below; supercilium less distinct; iris yellow until c. 4th year. Considerable geographical variation, with races separated on size, coloration and

plumage pattern, but much variation clinal; palest forms from boreal zone of Palearctic; race *albidus* polymorphic.

Habitat. Mature woods, particularly coniferous, but also deciduous or mixed; mostly near edges of wood. Both lowlands and mountainous areas, from sea-level up to mountainous subalpine woods; widespread across taiga N to tree line. Greatly favours clearings, due to greater variety and availability of prey; maximum densities in areas where cultivation interspersed with patches of forest, with as little as 15% tree cover overall. Sometimes in town parks or in small woods in essentially treeless areas.

Food and Feeding. Small and medium-sized birds and mammals, up to size of grouse, even capercaillies and hares; other vertebrates normally of minor importance, although lizards important in C Spain. Not specialized, and relative importance of birds or mammals varies from one region to another and even between seasons: in boreal regions, Tetraonidae (grouse, etc.) are fundamental, accounting for up to 80% of prey, particularly for chicks and juveniles; in North America, ground squirrels and sometimes hares very important; in parts of Europe with fairly extensive agriculture, partridges, pheasants and rabbits predominate. Wide range of small and medium-sized birds of varying importance in diet: pigeons (up to 30% or more in C Europe), corvids, thrushes and starlings, many nesting and fledgling birds during breeding season. Hunts from hidden perch or with inconspicuous surveying flight; prey mainly caught on ground, typically in clearings and around edges of woods.

Breeding. Laying in Apr and early May. Solitary; neighbouring pairs normally several kilometres apart, rarely less than 1 km. Nests in large trees; nest built in fork, or on branch near trunk or touching it; up to 20+ m above ground; built by both adults with sticks, lined with twigs and fresh leaves. Normally various nests (up to 6) per nesting territory, but often same nest used at least 2 years running. 1-5 eggs, normally 3-4; replacement laying occurs; incubation 35-38 days per egg, almost exclusively by female; most food brought by male; female feeds chicks and also hunts, near nest, during second half of breeding period; chicks have greyish white first and second down; fledging 34-37 days (males) or 37-41 days (females); independent at 70-90 days, females c. 1 week later than males. In North America, nest vigorously defended against intruders, including man. Sexual maturity at 2-3 years, sometimes at 1 year old (especially females). Heavy failure rate, and loss of 40% of clutches not uncommon, partly due to destruction or robbing of nests by man; average 1.4-3.1 chicks fledge per successful pair. Oldest recorded bird 19 years.

Movements. Mainly sedentary; partially migratory in northernmost populations of North America. Fenno-Scandia and Russia. Scale and extent of movements dictated by cycles of prey abundance in Arctic regions. Irruptions occur roughly every decade in North America, with birds reaching S USA and N Mexico. In Fenno-Scandia, movements far less extensive, not normally involving more than a few hundred kilometres. Migrants leave N areas mainly in Oct-Nov, returning to breeding zones in Mar-Apr.

Status and Conservation. Not globally threatened. CITES II. Significant decline in Europe during 19th century and part of 20th, mainly due to persecution and deforestation; subsequent trends generally less regular, but sharp drop in 1950's and 1960's, particularly in W Europe, linked with pollution by pesticides and heavy metals. Despite continued persecution and nest robbing for falconry, in 1980's and 1990's species tending towards stabilization or recovery; numerous and increasing in much of former USSR; population of North America apparently stable overall. Regional recolonization, notably in Britain, where species extinct from 19th century; re-established in late 1960's, apparently from escaped or released falconers' birds; also favoured by reforestation, both natural and managed, e.g. in Ukraine, expanding towards S in plantations. Only rough figures available, including, in early 1990's: 70,000 pairs in European Russia; 4500-5000 pairs in Byelorussia; no more than 100 pairs in Azerbaijan; 1000-1500 pairs in Bulgaria; c. 2300 pairs in Austria. Figures from 1980's for other sizeable European populations: 2300-3000 pairs in Spain; 3000-4500 pairs in France; 1500-1800 pairs in Netherlands; 4200-4700 pairs in Germany; c. 8000 pairs in Poland; c. 2000 pairs in Czechoslovakia; c. 1500 pairs in Hungary; 2000-3000 pairs in Norway; 5000 pairs in Sweden; 6000 pairs in Finland. Only a few dozen pairs in Morocco; 100-250 pairs in Turkey; estimated breeding population of at least 300-480 birds in Japan.

Bibliography. Ali & Ripley (1978), Bergier (1987), Bergman (1961), van Beusekom (1972), Bijlsma (1991), Brazil (1991), Brown *et al.* (1982), Brüll (1964), Cramp & Simmons (1980), Dementiev & Gladkov (1951), Dietzen (1978), Dobler (1990), Etchécopar & Hie (1978), Fischer (1983a), Flint *et al.* (1984), Gensbøl (1986), Gladkov (1941), Glutz von Blotzheim *et al.* (1971), Goszczynski & Pilatowski (1986), Handrinos & Demetropoulos (1983), Haukoja & Haukoja (1970), Hell (1964), Henny *et al.* (1985), Höglund (1964a, 1964b), Johngard (1990), Kalarh (1984), Kennedy (1987), Kenward (1977, 1978, 1981, 1982), Kenward & Lindsay (1981), Kenward *et al.* (1981, 1993), Kimberly & Mosher (1981), Kjellen (1992), Kozłowska (1986, 1987, 1991), Kozłowska & Kozłowska (1990, 1991), Kramer, (1955), Lindén & Wikman (1983), Lönnberg (1923), Looft (1981), Mañosa (1991, 1994), Marström & Kenward (1981, 1991), Marquiss & Newton (1982b), McGowan (1975a), Möller (1987), Moore & Henny (1983), Mueller & Berger (1967b, 1968), Mueller *et al.* (1976, 1977), Opdam (1975), Opdam *et al.* (1977), Palmer (1988), Petty (1989), Pineau & Giraud-Audine (1977), Rasmussen & Storgard (1989), Reynolds & Meslow (1984), Reynolds & Wight (1978), Reynolds *et al.* (1982), Roberts (1991), Rogacheva (1992), Schnell (1958), Simeonov *et al.* (1990), Sládek (1963), Snyder & Wiley (1976), Speiser & Bosakowski (1981, 1984, 1991), Stoner (1954), Sulkava (1964a), Sulkava *et al.* (1994), Thiollay (1967), Timmergen (1936a, 1936b), Utendörfer (1952), Watell (1973), Whaley (1988), Whaley & White (1994), Widén (1984, 1985, 1987, 1989), Wikman (1975), Wyrwoll (1977), Ziesemer (1983).

143. Meyer's Goshawk

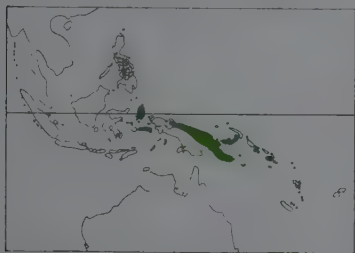
Accipiter meyerianus

French: Autour de Meyer **German:** Meyerhabicht **Spanish:** Azor de Meyer
Other common names: Papuan Goshawk

Taxonomy. *Accipiter meyerianus* Sharpe, 1878, Anson, Yapen Island.

Possibly forms superspecies with *A. gentilis*, *A. melanoleucus* and *A. henstii*. Geographical variation may exist. Monotypic.

Distribution. Halmahera and Seram (Moluccas) through N & E New Guinea to New Britain and Solomon Is (on Kolombangara and Guadalcanal).



Descriptive notes. 48-56 cm; male 530 g, female 1100 g. Large *Accipiter*, similar to *A. gentilis*, but with black and white much more contrasted. Melanistic plumage in some adults, similar to rare melanistic morph of *Erythrotriorchis buergeri*, but with fewer and more obscure tail bars; present species also has red, as opposed to yellow, eyes. Female larger, more distinctly barred on flight-feathers and underparts. Juvenile mottled brown, with streaked underparts.

Habitat. Hill and montane rain forest, forest edge and adjacent native gardens; near sea-level to at least 2700 m. Nests in forest.

Food and Feeding. Little known. Birds of many species, commonly including Papuan Mountain-pigeon (*Gymnophaps albertisii*); also free-ranging domestic fowl in native villages. Hunts on favoured perches with a wide view; also flies over forest ridges and terraces in early morning when pigeons are feeding and takes them as they fly up, or soars high and stoops on flying pigeon flocks, seizing prey in the air.

Breeding. Season apparently long, from austral winter to early summer: copulation observed late May/early Jun; specimen in breeding condition in Sept; one clutch hatching early Dec; one brood of dependent flying young mid-Aug. Solitary. Nests in very tall trees, including beech (*Nothofagus*). One complete clutch of 3 eggs; both sexes incubate; one fledged brood of 2 young. No further information.

Movements. Unknown; no records outside normal range.

Status and Conservation. Not globally threatened. CITES II. Scarce, and seldom encountered by ornithologists; biology poorly known. Possibly subject locally to effects of deforestation, and to breeding failure through eggshell thinning where DDT used, but data lacking.

Bibliography. Ammann (1964), Beahler *et al.* (1986), Bowler & Taylor (1980), Cates (1985), Danks *et al.* (1994), Diamond (1985), Diamond & LeCroy (1979), Majnep & Bulmer (1977), Mayr (1934), Rand & Gilliard (1967), Watell (1973), White & Bruce (1986).

Genus *ERYTHROTRIORCHIS* Sharpe, 1875

144. Chestnut-shouldered Goshawk

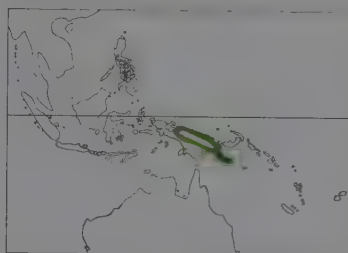
Erythrotriorchis buergeri

French: Autour de Bùrgers **German:** Prachthabicht **Spanish:** Azor de Bùrgers
Other common names: Bùrgers'/Buergers' Goshawk/Sparrowhawk, Chestnut-shouldered Hawk

Taxonomy. *Astur buergeri* Reichenow, 1914, Augusta River, Mäanderberg, New Guinea.

Formerly placed in superficially similar genus *Accipiter*, but now considered closely related to *E. radiatus* and to form part of old endemic Australasian clade (see page 55). Monotypic.

Distribution. N & E New Guinea.



Descriptive notes. 43-53 cm, female larger; male 575 g. Shorter wings, and more pied than congener, lacking rufous on underparts. Rare melanistic morph occurs in some adults, similar to melanistic *Accipiter neovernatus*, but with more and narrower tail bars and yellow eyes. Juvenile rich rufous, marked black, with sooty flight-feathers and tail.

Habitat. Hill and lower montane rain forest from 450 m to 1580 m.

Food and Feeding. Poorly known, but apparently takes mostly birds. Seen pursuing Hooded Butcherbird (*Circus caesus*), and feeding on unidentified bird. Seen perching in tree on ridge before making direct flying attack at distant prey in forest; also hunts by soaring.

Breeding. A fully grown but dependent juvenile, emitting begging calls, observed in Oct. No further information.

Movements. Unknown; no records outside normal range.

Status and Conservation. Not globally threatened. CITES II. Scarce, and seldom encountered by ornithologists; biology unknown. Likely to be affected by deforestation, and by breeding failure through eggshell thinning where DDT used, but data lacking.

Bibliography. Andrew (1992), Beahler (1978), Beahler *et al.* (1986), Coates (1985), Debus & Edelman (1994), Debus *et al.* (1994), Diamond (1972, 1985), Rand & Gilliard (1967), Schodde (1993), Watell (1973).

145. Red Goshawk

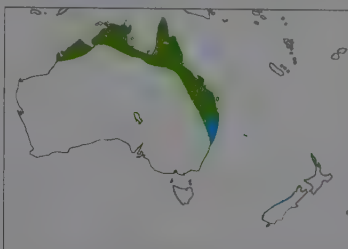
Erythrotriorchis radiatus

French: Autour rouge **German:** Fuchshabicht **Spanish:** Azor Rojo

Taxonomy. *Falco radiatus* Latham 1801, Sydney, New South Wales.

Has been merged in *Accipiter*, but recent studies show it to be unrelated to that genus; now regarded as part of old endemic Australasian clade (see page 55). Proposed race *rufifrons* invalid. Monotypic.

Distribution. N & E Australia, from Kimberley's round to N New South Wales.



Descriptive notes. 46-61 cm; male 630-640 g, female 1110-1370 g; wingspan 111-136 cm. Longer wings, and adult plumage generally more rufous than in *E. buergeri*. Superficially like *Accipiter*, but has loose, streaky plumage, occipital crest, longer wings, and very powerful legs and feet. Female much larger, with whiter underparts. Juvenile more rufous, particularly on head and breast.

Habitat. Coastal and sub-coastal open forest and woodland, often riparian, in tropics and subtropics; from sea-level to c. 1000 m. Nests in forest and tall woodland, near water.

Food and Feeding. Mostly birds, particularly

parrots and pigeons; sometimes herons, ducks, cockatoos (*Calyptorhynchus*), large kingfishers (*Dacelo*); occasionally megapodes (*Alectura*) of up to 2000 g. Rarely mammals, including fruit-bat (*Pteropus*) and young hare; also reptiles (snakes, lizards) and large insects. Forages by short-stay perch-hunting from concealed position in trees, early and late in day; long gliding or flapping transects and low quartering through, or just above, tree canopy; also high soaring flight, in middle of day. Often seizes prey in flight after stealthy glide or direct flying attack that becomes vigorous chase; also stoops on prey from a height.

Breeding. May-Oct in N, Aug-Oct in E Australia. Solitary. Usually monogamous; one male possibly bigamous with females in neighbouring territories. Platform of sticks 60-120 cm wide and 30-50 cm deep, lined with green leaves; placed 15-29 m above ground in exposed fork of tallest emergent living or partly dead tree. Usually 2 eggs (1-2); incubation 39-43 days; chicks have white down; fledging 51-53 days for males (probably slightly longer for females); post-fledging dependence of at least 10-11 weeks. Sexual maturity probably at 2 years or older, no breeding in juvenile plumage. Success 0.9 young fledged per attended nest, 1.3 per successful nest; nests and young sometimes destroyed by bush fires.

Movements. Poorly known. Breeding adults sedentary, though may expand home range in non-breeding season; regularly ranges 8-10 km from nest. Juveniles apparently dispersive, as inferred from sightings up to 500 km from known breeding sites.

Status and Conservation. VULNERABLE. CITES II. Scarce, with specialized requirements, and locally restricted within continental range declining, with contraction of breeding range in E Australia through habitat loss. Total population estimated at c. 350 breeding pairs, most of which occur in N. Has low breeding density and recruitment rate. Breeding success is threatened through egg-collecting, and locally by disturbance from birdwatchers and photographers at nests. Probably affected locally by DDT use (now ceased), but insufficient data to assess changes in eggshell thickness. Conservation measures required include monitoring of known breeding territories in N Australia; also survey in E Australia to locate breeding territories, which should subsequently be secured and monitored.

Bibliography. Andrew (1991), Ammann & Baker-Gibb (1991), Blakers *et al.* (1984), Brickhill (1991), Cullar & Andrew (1988), Debus (1991c, 1993b), Debus & Czechura (1988a, 1988b), Debus, McAllan & Mead (1993a, 1993b).

Garnett (1992), Marchant & Higgins (1993), Olsen (1991), Olsen & Marples (1993), Olsen, Crome & Olsen (1993), Schodde (1993), Schodde & Tidemann (1988), Smith, L.E. (1991).

Genus *MEGATRIORCHIS*

Salvadori & D'Albertis, 1875

146. Doria's Hawk

Megatriorchis doriae

French: Autour de Doria **German:** Salvadorihabicht **Spanish:** Azor de Doria
Other common names: Doria's Goshawk

Taxonomy. *Megatriorchis doriae* Salvadori and D'Albertis, 1875, Yule Island, New Guinea. Has frequently been merged into superficially similar genus *Accipiter*, but now considered part of old endemic Australasian clade, related instead to *Erythrotriorchis* and others (see page 55). Monotypic.



Distribution. New Guinea; also recorded on Batanta I, off NW New Guinea.

Descriptive notes. 51-69 cm, female larger; female 1000 g. Distinctively barred and streaked; has powerful legs and feet like *Accipiter*, but shorter wings. Juvenile slightly paler and more rufous, lacks mask; may have pale head.

Habitat. Lowland and hill rain forest, monsoon forest and mangroves; also seen at interface between disturbed forest and secondary scrub; occurs from sea-level to 1650 m.

Food and Feeding. Little known. Birds, including Lesser Bird-of-paradise (*Paradisaea*

minor); also seen repeatedly snatching small (invertebrate?) prey from outer foliage. Spends much time inside forest canopy, where perches for long periods; waits in ambush at sites attractive to prey, e.g. flowering trees, or bird-of-paradise leks. Occasionally flies by forest edge or low over canopy.

Breeding. No information available.

Movements. Unknown, but presumably sedentary, as inferred from short wings and infrequent, slow flight; no records outside normal range.

Status and Conservation. Not globally threatened. CITES II. Scarce, and seldom encountered by ornithologists; biology unknown. Possibly affected by deforestation and DDT use in lowlands.

Bibliography. Andrew (1992), Beehler *et al.* (1986), Bishop (1986), Coates (1985), Diamond (1972), Finch (1981), Rand & Gilliard (1967), Schodde (1993).

Genus *UROTRIORCHIS* Sharpe, 1874

147. Long-tailed Hawk

Urotriorchis macrourus

French: Autour à longue queue **German:** Langschwanzhabicht **Spanish:** Azor Rabilargo

Taxonomy. *Astur macrourus* Hartlaub, 1855, Dabocrom, Ghana.

Monotypic genus, apparently very close to *Accipiter*, with which has been merged; has also been linked with other endemic African genera, *Melierax* and *Kaupifalco*. Invalid race *batesi* proposed for populations from Cameroon eastwards. Monotypic.

Distribution. Liberia E to W Uganda and S to SW & C Zaire.



Descriptive notes. 65-70 cm; male 492 g. Long, graduated tail with large white spots and white rump. Superficially similar in structure to Australasian *Megatriorchis*, but aspects of colour and behaviour recall chanting-goshawks (*Melierax*). A melanistic morph has been claimed to exist and even depicted, but is apparently unsubstantiated. Female larger than male. Juvenile variably marked below, sometimes with large spots typical of several African *Accipiter* and *Aviceda* species; others almost unmarked, possibly in an intermediate plumage, with fine white bars on underparts.

Habitat. Lowland tropical evergreen forest; ventures into adjacent gallery forest and also secondary forest.

Food and Feeding. Known to take squirrels, bats and rodents; stout legs and feet suggest preference for mammalian prey, but also takes some birds. Long tail permits agile pursuit around and among branches. Hunts more often at low levels in understorey than in forest canopy, sometimes near ground level along logging tracks. Difficult to observe, but will cross clearings and descend to ground; accused of taking some free-range poultry.

Breeding. Nesting habits undescribed. Adult seen feeding newly fledged juvenile in Sept, in Sierra Leone; probably Jul-Aug in Cameroon, based on condition of gonads in collected specimen. Calling within forest may reveal presence.

Movements. Resident and sedentary.

Status and Conservation. Not globally threatened. CITES II. Secretive but widely recorded from primary forest; restricted to large tracts of dense forest, although readily occurs at edge of clearings. Much affected by deforestation, due to intolerance of secondary habitats, and has probably decreased considerably throughout much of W Africa. Not uncommon in Sierra Leone; widespread and common in Ghana. Not known to be affected by pesticides.

Bibliography. Bannerman (1953), Brosset & Erard (1986), Brown *et al.* (1982), Cockburn (1946), Ferguson-Lees & Faull (1992), Gatter (1988), Grimes (1987), Kemp (1986), Lippens & Wille (1976), Mackworth-Præd & Grant (1957, 1970), Pinto (1983), Serle *et al.* (1977), Snow (1978).



148

149

150

151

ssp caeruleus

152

ssp gracilis

153

154

ssp nigra

155

156

157

158

ssp albicollis

ssp williaminae

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ssp costaricensis

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ssp ghiesbreghtii

Genus *BUTASTUR* Hodgson, 1843

148. Grasshopper Buzzard

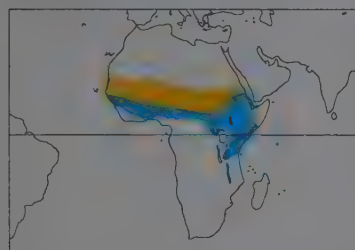
Butastur rufipennis

French: Busatour des sauterelles **German:** Heuschreckenteesa **Spanish:** Busardo Langostero

Taxonomy. *Poliornis rufipennis* Sundevall, 1851, Khartoum, Sudan.

Only African member of genus, forming superspecies with Asian *B. teesa*, *B. liventer* and *B. indicus*. Monotypic.

Distribution. Senegambia E to Ethiopia, migrating S to Sierra Leone, Cameroon, NE Zaire, Kenya and N Tanzania.



Descriptive notes. 35 cm; male 310-342 g, female 300-383 g. Rufous wing-coverts and underparts distinctive at all ages. Sexes indistinguishable. Juvenile with head and neck also rufous and darkly streaked below.

Habitat. Ranges from woodland and forest edge to arid thorn savanna; sometimes on edges of swamps and over burnt ground.

Food and Feeding. Mainly insects, especially grasshoppers, together with mantids, termite and ant alates, beetles, stick insects and spiders. Will take some other arthropods and a few small birds, reptiles and rodents. Breeding diet unstudied. Often gregarious in flocks

of 50-100 birds. Hunts from a low perch (on average 6 m up), taking 95% of prey from the ground, and hawking the remainder on the wing with buoyant flight; recorded catching some 0.2-1.6 items/hour. Attracted in flocks to fires, newly burnt areas and insect emergences; also follows flocks of egrets or herds of game for the insects they flush.

Breeding. Laying during rainy season: Mar-Apr across Sahel zone. Probably disperses to breed in territorial pairs. Builds substantial stick nest in fork of tree, often rather low down and lined with green leaves. 1-3 eggs; further details unrecorded.

Movements. A widespread and common intra-African sub-Saharan migrant, moving across 22° of latitude, S to the border of Guinea woodland and forest during the Oct-Mar dry season, when fires and grazing reduce cover, then departing N with first heavy rains to breed in semi-arid steppe during Mar-Sept. Also non-breeding migrant to E Africa, moving N through Taru Desert of lowland Kenya in Jan-Mar, and through NW Somalia in Sept-Oct. Well studied only on non-breeding range of W Africa.

Status and Conservation. Not globally threatened. CITES II. Locally abundant in several areas of W Africa during dry season, outnumbering all other raptors but *Milvus migrans*. Vulnerable to overgrazing and drought in Sahel zone, but nomadic to take advantage of local situations of plentiful prey. Recent decline in non-breeding visitors to Kenya. Not known to be affected by pesticides, but may be vulnerable to spraying for locusts.

Bibliography. Brown *et al.* (1982), Chapin (1932), Gore (1990), Grimes (1987), Lewis & Pomeroy (1989), Mackworth-Præd & Grant (1957-1973), Rasa (1987), Thiollay (1975a, 1975b, 1975c, 1976a, 1976b, 1977b, 1977c, 1978a, 1978c, 1985d), Thiollay & Clobert (1990).

149. White-eyed Buzzard

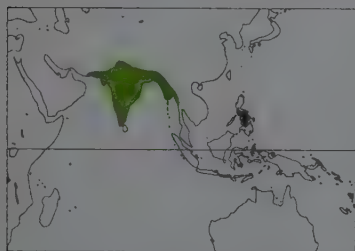
Butastur teesa

French: Busatour aux yeux blancs **German:** Weißaugenteesa **Spanish:** Busardo Tisa
Other common names: White-eyed Buzzard-Eagle

Taxonomy. *Circus Tessa* Franklin, 1831. Further India = Ganges and Narmada Rivers.

Forms superspecies with *B. rufipennis*, *B. liventer* and *B. indicus*. Monotypic.

Distribution. SE Iran, Afghanistan and Pakistan through India and Nepal to Burma (S to Tenasserim).



Descriptive notes. 36-43 cm; 325 g; wingspan 86-96 cm. Small greyish brown buteo-like raptor; striking white eye and rufous brown upper side of tail; white throat with wide dark central stripe; small to large white patch on nape; very variable pale patches on upwing-coverts can be extensive, and frequently conspicuous when bird is perched. Juvenile similar to adult, but paler on head and less heavily marked below.

Habitat. Dry, open country and cultivated areas in lowlands up to 300 m in Himalayas; occasionally higher.

Food and Feeding. Small mammals, lizards, frogs, snakes, crabs and large insects; occasionally birds. Hunts from perch, making short flights to ground to capture prey.

Breeding. Season Feb-May throughout range. Loose, unlined, crow-sized nest built by pair 8-12 m up tall tree, often in grove or village. Display flights as such unreported, but accounts of pair soaring over territory constantly calling may constitute display. Usually 3 eggs (2-4); incubation by female only, reported to last 19 days, but probably much longer; chicks have white down, buff-coloured on back; both parents feed young; fledging and dependency periods unrecorded.

Movements. Mainly sedentary. Some local movements in N Pakistan, in region of border with Afghanistan. Vagrant to Tibet.

Status and Conservation. Not globally threatened. CITES II. Common to fairly common locally; abundant in Pakistan. Over 100 birds seen at Sariska Tiger Reserve, Rajasthan (NW India), in 1989, during period of rodent abundance, but few recorded at same site in 1990. No threats known at present.

Bibliography. Ali & Ripley (1978), Cheng Tso-hin (1987), Clark & Schmitt (1992), Inskipp & Inskipp (1985), King *et al.* (1975), Meyer de Schauensee (1984), Roberts (1991), Smythies (1986)

150. Rufous-winged Buzzard

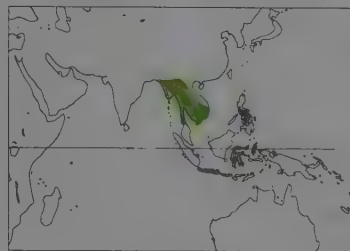
Butastur liventer

French: Busatour pâle **German:** Malaienteesa **Spanish:** Busardo Alirrufo
Other common names: Rufous-winged Buzzard-Eagle

Taxonomy. *Falco liventer* Temminck, 1827, Java.

Forms superspecies with *B. rufipennis*, *B. teesa* and *B. indicus*. Monotypic.

Distribution. Burma and SC China (SW Yunnan) S to Indochina and N Malay Peninsula: Java; Sulawesi. Reported occurrence in SE Borneo doubtful; old record of questionable validity from Timor.



Descriptive notes. 35-40 cm; 336-340 g; wingspan 83-91 cm. Small, buteo-like raptor with rufous wings and tail. Juvenile has rufous buff head, neck and underparts.

Habitat. Open country, savanna and scrub; also near rivers and swamps in lowland plains, up to at least 800 m. Sometimes found in towns and villages.

Food and Feeding. Small mammals, lizards, frogs, crabs and insects. Hunts from exposed perch, making short flights to ground to capture prey. Regularly soars.

Breeding. Laying Feb-Mar/Apr in Java; probably Jun-Jul in Sulawesi. Large, solid nest built by pair in crown of large, solitary tree; lined with leaves. Usually 2-3 eggs. No further information available.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES II. Throughout most of range fairly common to uncommon, but local: rare in Yunnan (SC China) and Java. Not encountered in Java during recent raptor surveys.

Bibliography. Bishop *et al.* (1994), Cheng Tso-hin (1987), Coomans de Ruiter (1947), Deignan (1945), King *et al.* (1975), Lekagul & Round (1991), MacKinnon (1988), Meyer de Schauensee (1984), Smythies (1986), Stresemann (1940a), White & Bruce (1986).

151. Grey-faced Buzzard

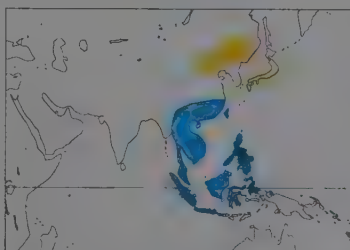
Butastur indicus

French: Busatour à joues grises **German:** Kiefernteesa **Spanish:** Busardo Carigrís
Other common names: Frog Hawk

Taxonomy. *Falco indicus* Gmelin, 1788, Java.

Forms superspecies with *B. rufipennis*, *B. teesa* and *B. liventer*. Monotypic.

Distribution. NE China to Amurland and Ussuriland, Japan and Izu Is. Winters from S & SE China and Taiwan through Indochina and Malay Peninsula to Greater Sundas, Philippines, Sulawesi and islands off NW New Guinea.



Descriptive notes. 46 cm. White throat with dark mesial streak; head greyish brown; brown above and on upper breast; rest of underparts, including thighs, whitish, broadly barred brown; eyes, cere, legs and feet yellow. Juvenile generally paler, especially on head and breast; breast streaked brown.

Habitat. Wooded areas in proximity of open country, e.g. pastures, peat bogs; often near water, e.g. marshes, paddyfields, etc., in which finds considerable proportion of prey. Prefers low mountains, hills and foothills to absolutely flat land, and mixed woods to unvaried deciduous woods; generally favours

evergreen forest for nesting; perches in: nests in woods.

Food and Feeding. Mainly frogs, reptiles (snakes, lizards), rodents and possibly birds. Often hunts from perch, typically at top of dead tree, waiting to spot prey and dive down on it; forages mainly in morning and evening.

Breeding. Laying May. Fairly small nest of twigs and sometimes sedges, built in tree, normally conifer, 4-14 m above ground; lined with bits of bark, grass and green leaves, which continue to be added throughout breeding. 2-4 eggs; incubation 28-30 days; fledging 34-36 days; in Ussuriland chicks start to hunt for themselves in second half of Aug.

Movements. Migratory; flocks of thousands of birds sometimes gather. Sets off for winter quarters mainly in Sept. or up to mid-Oct from Japan. Major migration route along Pacific coast of Japan, through Ryukyu Is to Taiwan and S to Philippines (where migration more concentrated in autumn); of 101 ringed birds recovered in Philippines, 99 had been ringed in Ryukyu Is. Also passes through parts of continental E Asia in some numbers, e.g. not uncommon in Korea during both spring and autumn migrations. Returns to breeding grounds in Ussuriland during first half of Apr. and to those in C Honshu (Japan) in late Apr or early May.

Status and Conservation. Not globally threatened. CITES II. Size and trends of populations very poorly known. Not uncommon in Japan, nor perhaps in Ussuriland, where distances of 4-5 km between pairs are normal in large river valleys; however, Russian population apparently undergoing major decline; up to 1000 migrants shot annually on Taiwan. Abundant on migration in various parts of Japan; one of commonest migrant raptors in Thailand

Bibliography. Anon. (1988), Beebler *et al.* (1986), Brazil (1991), Brazil & Hanawa (1991), Chang (1980), Cheng Tso-hin (1987), Ching *et al.* (1989), Coates (1990), Deignan (1945), Dementiev & Gladkov (1951), Dickinson *et al.* (1991), Ehimekenshi *et al.* (1989), Etchecopar & Hue (1978), Flint *et al.* (1984), King *et al.* (1975), Knyshtaus (1993), Kojima (1982, 1987), Lin & Lin (1986), MacKinnon (1988), van Marle & Vnouk (1988), McClure (1974), Medway & Wells (1976), Meyer de Schauensee (1984), Severinghaus (1991), Smythies (1981, 1986), Takeda (1989)

On following pages: 152. Crane Hawk (*Geranospiza caerulescens*); 153. Plumbeous Hawk (*Leucopternis plumbea*); 154. Slate-coloured Hawk (*Leucopternis schistacea*); 155. Barred Hawk (*Leucopternis princeps*); 156. Black-faced Hawk (*Leucopternis melanops*); 157. White-browed Hawk (*Leucopternis kuhli*); 158. White-necked Hawk (*Leucopternis lucervulata*); 159. Semiplumbeous Hawk (*Leucopternis semiplumbea*); 160. White Hawk (*Leucopternis albigollis*); 161. Grey-backed Hawk (*Leucopternis occidentalis*); 162. Mantled Hawk (*Leucopternis polionota*).

Genus *GERANOSPIZA* Kaup, 1847

152. Crane Hawk

Geranospiza caerulescens

French: Buse échasse **German:** Sperberweihe **Spanish:** Azor Zancón
Other common names: Blackish Crane-hawk (*nigra*); Grey Crane-hawk (*caerulescens*); Banded Crane-hawk (*gracilis*)

Taxonomy. *Sparvius caerulescens* Vieillot, 1817, Cayenne.

Genus *Ischnosceles* is best regarded as forgotten name. Relation of genus unclear; probably allied to Neotropical sub-buteonines, rather than Afrotropical *Polyboroides*. Substantial geographical variation, with three well defined groups, perhaps approaching separate species status: *nigra* group, including races *livens* and *balzarensis*; *caerulescens* group; and *gracilis* group, including race *flexipes*. However, extensive intergradation between *nigra* group and *caerulescens*. At other extreme, some authorities recognize only two or three races. Six subspecies normally recognized.

Subspecies and Distribution.

G. c. livens Bangs & Penard, 1921 - NW Mexico.

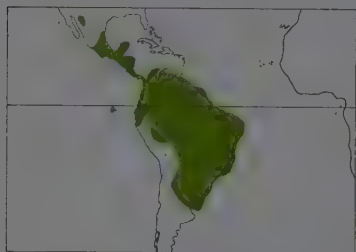
G. c. nigra (Du Bus de Gisignies, 1847) - N Mexico (Sinaloa and Tamaulipas) S to zone of Panama Canal.

G. c. balzarensis W. L. Sclater, 1918 - Panama E of canal zone on Pacific slope to W Colombia, W Ecuador and NW Peru (Lambayeque).

G. c. caerulescens (Vieillot, 1817) - E slope of Colombia and Ecuador to the Guianas and Amazonian Peru and Brazil.

G. c. gracilis (Temminck, 1821) - NE Brazil, from Maranhão, Ceará and Piauí to C Goiás and Bahia.

G. c. flexipes Peters, 1935 - S Brazil (Minas Gerais, S Goiás and Mato Grosso) and Bolivia through Chaco of Paraguay, to NC Argentina (S to La Rioja, Córdoba and Buenos Aires) and Uruguay.



Descriptive notes. 43-51 cm; male 225-358 g, female 273-353 g, maximum 430 g. Very long legs, particularly the tarsometatarsus. Plumage generally bluish grey, slate or blackish; some forms have varied extents of fine white barring below, and sometimes also on upperwing; long, slender tail black with two conspicuous white or buff bands and narrow white tip; prominent white crescent in primaries visible in flight. Superficially recalls Afrotropical *Polyboroides*, but smaller and more lightly built, with relatively longer legs. Tarsi orange red, iris crimson, cere leaden. Female similar, but larger. Immature dark

above, lightly tinged with brown; head streaked with white; below barred with buff on belly and legs. Races separated primarily by overall body colour and amount of vermiculation on wings and underparts: race *livens* similar to *nigra*, but paler; race *balzarensis* similar to *livens*, but smaller; race *flexipes* like *gracilis*, but even more intensively barred.

Habitat. Very adaptable; in lowlands, from dry forest to rain forest, mangroves, wooded savanna or grassland with gallery forest, or tall second growth, often near ponds and marshes. Up to 500 m in Colombia, 730 m in Mexico.

Food and Feeding. Very versatile, feeding on lizards, snakes, frogs, nestling birds and large arthropods (Orthoptera and spiders); one record of a bat. Clings to tree trunk somewhat like a woodcreeper (Dendrocolaptidae); double-jointed leg used for reaching into hollows in trees, and probably also into long, narrow gaps between tight-packed leaves of bromeliads, whither tree frogs retreat; observed hanging upside down plundering bird's nest in palm tree. Sometimes drops from trees to prey on the ground; also feeds on the wing, in forest as well as open country, coursing low in manner of harrier. Sometimes hunts near fires, where prey may be flushed.

Breeding. Laying rather prolonged (Apr-Jun) in Mexico; Jan in Panama; Jul in NE Colombia; mostly rainy season (Jul-Sept) in Venezuela; Apr in Surinam. Nest of sticks and vines, lined with grass, weeds and fine twigs and trimmed with fresh leaves; built in tall trees. Courtship is quite vocal and includes more or less elaborate aerial displays and courtship feeding. 2 eggs. No further information available.

Movements. Unknown, presumably mostly sedentary.

Status and Conservation. Not globally threatened. CITES II. Generally not common, but extensive geographical range and broad habitat tolerance suggest little grounds for immediate concern. In Colombia, widespread but local and rarely common.

Bibliography. Belton (1984), Blake (1977), Bokermann (1978), Burton (1978), Contreras *et al.* (1990), Haverschmidt (1962), Hilty & Brown (1986), Jehl (1968), Lowery & Dalquest (1951), Mader (1981), Meyer de Schauensee & Phelps (1978), Monroe (1968), Olmos (1990a), Ouellet (1991), de la Peña (1992), Pinto (1964), Ridgely & Gwynne (1989), van Rossem (1945), Sick (1985a, 1993), Stud (1964), Smeenk & Smeenk-Enserink (1983), Stiles & Skutch (1989), Sutton (1954), Sutton & Burleigh (1939), Tostain *et al.* (1992), Voous (1969), Wetmore (1965).

Genus *LEUCOPTERNIS* Kaup, 1847

153. Plumbeous Hawk

Leucopternis plumbea

French: Buse plombée **German:** Bleibussard **Spanish:** Busardo Plomizo

Taxonomy. *Leucopternis plumbea* Salvin, 1872, Ecuador.

Forms superspecies with *L. schistacea*, of which it was formerly considered a subspecies. Monotypic.

Distribution. E Panama through W Colombia and W Ecuador to extreme NW Peru.

Descriptive notes. 35-37 cm. Leaden grey overall; wings black, single conspicuous white or greyish band through black tail; underwing-coverts white; thighs finely barred with white. Iris brownish



orange, cere and legs yellowish orange. Rather smaller than closely related *L. schistacea*, differing also in colour of bare parts and underwing-coverts. Female similar to male, but averages very slightly larger. Immature has more conspicuous barring on thighs and faint grey mottling on belly.

Habitat. Tropical rain forest in lowlands and foothills, up to 800 m. Not known to soar.

Food and Feeding. Little known: frogs, crabs, fish and water snakes. Hunts along banks of rivers and lakes; probably captures prey mainly by perch-hunting.

Breeding. No information available.

Movements. No information available; presumably sedentary.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Status very poorly known, but in general rare to uncommon. May have been extirpated from W Panama; apparently rare in Colombia. Low density and relatively restricted range in a region where deforestation is on the increase are grounds for concern; surveys and research required.

Bibliography. Amadon (1982b), Blake (1977), Brown & Amadon (1968), Collar & Andrew (1988), Davis (1972), Hilty & Brown (1986), Ridgely & Gwynne (1989), Ruschi (1979), Sick (1985a, 1993), Wetmore (1965).

154. Slate-coloured Hawk

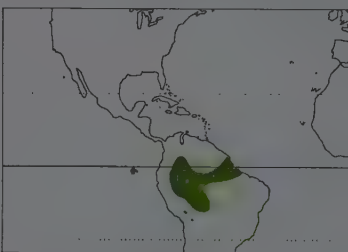
Leucopternis schistacea

French: Buse ardoisée **German:** Schieferbussard **Spanish:** Busardo Pizarroso

Taxonomy. *Asturina schistacea* Sundevall, 1851, Brazil.

Previously placed in *Buteogallus*. Forms superspecies with *L. plumbea*, with which it has been considered conspecific. Monotypic.

Distribution. Amazonia, from SE Colombia and SW Venezuela S through E Ecuador and E Peru to N & E Bolivia, and E to E French Guiana and CN Brazil.



Descriptive notes. 39-43 cm; female 455 g. Dark leaden grey; blackish on head and wings; tail black, narrowly tipped white, with a bold white bar; underwing-coverts blackish. Iris, cere and feet yellowish red. Larger than closely related *L. plumbea*, differing also in colour of bare parts and underwing-coverts. Female similar to male, but averages very slightly larger. Immature has belly, thighs and underwing finely barred with white.

Habitat. Tropical lowland forest, up to 500 m in Colombia; usually near swamps or streams in várzea forest; frequents mangroves, occurring in more advanced successional stages than *Buteogallus*; also lagoons, rivers and gallery forest in S llanos of Venezuela. Rarely, if ever, soars.

Food and Feeding. Snakes and frogs recorded. Observed attacking troops of squirrel monkeys, and also Cock-of-the-rock (*Rupicola*) leks. Usually perches at medium or low levels alongside forest streams, dropping down to catch prey beside water, without entering water.

Breeding. No information available.

Movements. Presumably sedentary.

Status and Conservation. Not globally threatened. CITES II. Generally fairly common. Status uncertain, but extensive range suggests there is no need for immediate concern; surveys required to assess situation more definitely. Biology very poorly known.

Bibliography. Amadon (1982b), Blake (1977), Brown & Amadon (1968), Hilty & Brown (1986), Meyer de Schauensee & Phelps (1978), Pinto (1964), Remsen & T aylor (1989), Sick (1985a, 1993), Terborgh (1983), Tostain (1986b), Trail (1987).

155. Barred Hawk

Leucopternis princeps

French: Buse barrée **German:** Prinzenbussard **Spanish:** Busardo Azoreño

Taxonomy. *Leucopternis princeps* P. L. Sclater, 1865, Costa Rica.

Populations of Ecuador and Colombia have been assigned to separate race, *zimmeri*, on grounds of differences in size, but this is unsubstantiated. Monotypic.

Distribution. Costa Rica and Panama, and locally into W Colombia and N Ecuador on both sides of the Andes.



Descriptive notes. 55-59 cm; c. 1000 g. Black above and below on throat and upper breast; feathers of crown, nape and mantle edged bluish slate; belly and underwing-coverts white, finely barred with black. Cere and legs bright yellow. Much smaller than *Geranoaetus melanoleucus* and quite different shape; occurs in totally different habitat. Female similar, but marginally larger than male. Immature has white edging to upperwing-coverts.

Habitat. Mountain forests, from foothills up to subtropical zone; rare in coastal plains of Colombia. Conflicting reports on altitudinal

preferences: in SE Ecuador and NW Colombia, primarily 1200-2225 m, and rarely below 1000 m; but elsewhere reported mainly from 300-1800 m in Colombia. Associated more with natural or man-made clearings and forest edge than with extensive tracts of undisturbed forest. Often soars over forest, sometimes in groups of 3-4.

Food and Feeding. Assumed to feed on reptiles, but this is apparently based on only 1 prey record, a snake. Perch-hunts within forest, sometimes at low level.

Breeding. No information available.

Movements. Presumably sedentary.

Status and Conservation. Not globally threatened. CITES II. Too little known to permit accurate assessment of status, but propensity to use forest edge suggests it is not a species of imminent concern. Conspicuous, due to habit of soaring, and relatively frequently seen within its altitudinal range at one site in NW Colombia.

Bibliography. Amadon (1982b), Blake (1977), Brown & Amadon (1968), Davis (1972), Hilty & Brown (1986), Ridgely & Gwynne (1989), Robbins *et al.* (1987), Slud (1964), Stiles & Skutch (1989), Thiollay (1991a), Wetmore (1965).

156. Black-faced Hawk

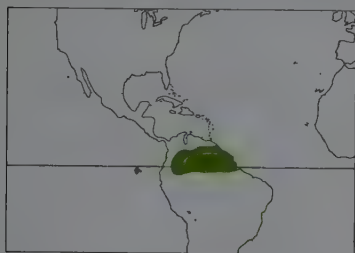
Leucopternis melanops

French: Buse à face noire **German:** Zügelbussard **Spanish:** Busardo Carinegro

Taxonomy. *Falco melanops* Latham, 1790, Cayenne.

Forms superspecies with *L. kuhli*. Monotypic.

Distribution. The Guianas and Amazonia N of Amazon R to E Colombia and E Ecuador. Specimens from R Tapajós (S of Amazon) may refer to *L. kuhli*.



Descriptive notes. 38-41.5 cm; 297-317 g. Head, upper back and neck white, streaked black; wings and tail black, with wing-coverts and scapulars boldly marked white; single narrow white band across middle of tail; underparts entirely white. Eye grey or tan, legs and cere yellow or orange-yellow. Separated from similar congeners by tail pattern: from *L. kuhli* by head pattern. Female similar to male, but larger. Immature has only very faint dark streaking on head and neck; brownish margins to feathers of back and upperwing.

Habitat. Lowland rain forest; may favour dense vegetation along rivers and mangroves.

Never soars over forest.

Food and Feeding. Very few data available, but probably reptiles to a greater or lesser extent. One bird observed eating snake on ground, having first removed head; another record of a lizard as prey; also seen preying on nestling dove.

Breeding. No information available.

Movements. No information available; presumably sedentary.

Status and Conservation. Not globally threatened. CITES II. Status very poorly known. Apparently rare throughout, but very secretive and often overlooked; most of forest in extensive range persists, so probably not a species of immediate concern.

Bibliography. Amadon (1964, 1982b), Blake (1977), Brown & Amadon (1968), Hilty & Brown (1986), Meyburg (1986), Meyer de Schauensee & Phelps (1978), Pinto (1964), Sick (1985a, 1993), Snyder (1966), Thiollay (1989a).

157. White-browed Hawk

Leucopternis kuhli

French: Buse à sourcils blancs **German:** Weißbrauenbussard **Spanish:** Busardo Cejiblanco

Taxonomy. *Leucopternis Kuhli* Bonaparte, 1850, no locality = Pará, Brazil.

Forms superspecies with *L. melanops*, with which has been considered conspecific, but the two may be sympatric on lower R Tapajós, Brazil (validity of *melanops* specimens from Tapajós have been questioned). Monotypic.

Distribution. E Peru (C Loreto S to Madre de Dios), N Bolivia (Pando) and Amazonian Brazil S of R Amazon (from R Madeira E to E Pará).



Descriptive notes. 37-40 cm. Dark head with narrow white eyestripe. Black above with some white streaks or splotches on nape and mantle, and single narrow white band through tail; all white below, except grey wingtips boldly barred black. Iris brown or reddish brown, cere, legs and feet orange. Female similar to male, but larger.

Habitat. Tropical rain forest in lowlands.

Food and Feeding. Very little known: a snake and a lizard reported. Hunts near the forest floor.

Breeding. No information available.

Movements. No evidence of any movements.

Status and Conservation. Not globally threatened. CITES II. Very poorly known, but so much forest in its extensive range remains intact that species can not be considered of immediate concern. Surveys and research required.

Bibliography. Amadon (1982b), Blake (1977), Brown & Amadon (1968), Dunning (1982), Remsen & T aylor (1989), Robbins *et al.* (1991), Sick (1985a, 1993).

158. White-necked Hawk

Leucopternis lacernulata

French: Buse lacernulé **German:** Weißhalsbussard **Spanish:** Busardo Cuelliblanco

Taxonomy. *Falco lacernulatus* Temminck, 1827, Rio de Janeiro, Brazil.

Probably most closely allied to *L. kuhli* and *L. melanops* of Amazonia. Monotypic.

Distribution. E Brazil, from Alagoas and S Bahia to São Paulo and Santa Catarina.

Descriptive notes. 43-48 cm; wingspan 96 cm. Head and underparts white; upperparts dark; tail black, with thick white bar. Iris brown or pale yellow, legs and feet yellow. Tail pattern separates from congeners. Female similar, but larger. Immature like adult, but with dark streaks on crown and nape; rufous brown tips to wing-coverts and scapulars; irregular white barring on basal half of tail.

Habitat. Dense primary Atlantic forest, occurring at lower altitudes in valleys. Will perch in the canopy, but most often seen in the middle storeys of the forest.

Food and Feeding. Very few data available; apparently a broad generalist, as prey recorded includes reptiles (e.g. snakes), mammals, birds, snails, insects (ants, beetles, Orthoptera) and large spiders;



arthropods may predominate. Prey taken on the ground. Follows army ants, preying on flushed insects.

Breeding. No information available.

Movements. Sedentary.

Status and Conservation. VULNERABLE/RARE. CITES II. Although reported in a number of protected reserves, species should be considered vulnerable owing to low population densities, significant distances between protected areas, and massive deforestation of its habitat outside protected areas. Shooting is also a threat. Surveys and research required.

Bibliography. Albuquerque (1986), Amadon (1964,

159. Semiplumbeous Hawk

Leucopternis semiplumbea

French: Buse semiplombée **German:** Möwenbussard **Spanish:** Busardo Semiplomizo

Taxonomy. *Leucopternis semiplumbeus* Lawrence, 1861, Caribbean slope of Panama.

Monotypic.

Distribution. Honduras S to W Colombia (E to Magdalena Valley) and NW Ecuador (Esmeraldas).



Descriptive notes. 31-35 cm; male 250 g, female 325 g. Small, stocky *Leucopternis* with distinctive plumage and yellow eye. Above entirely lead grey, blackish on wings and tail; tail has one, or sometimes two, narrow white bands; below immaculate white but with wingtips grey, barred dusky. Eye bright yellow, cere reddish orange, legs and feet orange or reddish orange. Female similar, but somewhat larger. Immature has entire breast narrowly streaked dark grey; tail sometimes with three white bands.

Habitat. Humid forests of tropical and lower subtropical zones; forest edge, in and around

forest fragments, and in tall second growth in Colombia. Very rarely soars.

Food and Feeding. Little known: lizards and snakes; one record of an *Ameiva* lizard; reported attacking birds at an army ant swarm, but presumably also feeds on arthropods fleeing from the ants.

Breeding. One anecdotal record from Costa Rica in Jan: nest building in crown of a tall tree.

Movements. Apparently sedentary.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Perhaps of little concern at present, as is the commonest hawk in some areas of primary forest, and is tolerant of second growth.

Bibliography. Amadon (1982b), Blake (1977), Brown & Amadon (1968), Davis (1972), Hilty & Brown (1986), Monroe (1968), Ridgely & Gwynne (1989), Slud (1964), Stiles & Skutch (1989), Thiollay (1991a), Wetmore (1965).

160. White Hawk

Leucopternis albicollis

French: Buse blanche **German:** Schneebussard **Spanish:** Busardo Blanco

Taxonomy. *Falco albicollis* Latham, 1790, Cayenne.

Forms superspecies with *L. occidentalis* and *L. polionota*, both of which have been considered races of present species. Four subspecies recognized.

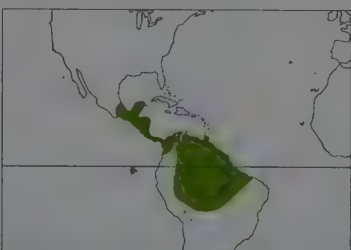
Subspecies and Distribution.

L. a. ghiesbreghtii (Du Bus de Gisignies, 1845) - S Mexico (Oaxaca and Veracruz) to Guatemala and Belize.

L. a. costaricensis W. L. Slater, 1919 - Honduras to Panama and W Colombia.

L. a. williaminae Meyer de Schauensee, 1950 - NW Colombia (upper Sinú and lower Magdalena Valleys S to Valle) and extreme NW Venezuela (Perijá).

L. a. albicollis (Latham, 1790) - E Colombia, NW Venezuela (NW Zulia), Trinidad and the Guianas through Amazonia to E Peru, E Ecuador, N & E Bolivia (La Paz, Santa Cruz) and C & E Brazil (C Mato Grosso and N Maranhão).



Descriptive notes. 47-51 cm; male 600-650 g, female 710-855 g. Remarkable variation in plumage between subspecies: ranges from almost entirely white to mostly black above, white below. Underparts invariably white; wings-coverts and back vary from all white to all black with narrow white scalloping; flight-feathers black; tail either all white with thick or thin black subterminal band, or mainly black with white tip. Legs yellow, cere dark grey; race *ghiesbreghtii* has brown eyes, not yellow as generally stated. Female similar but larger. Immature tends to have variable amounts of dusky streaking, especially on

head: some males and immatures of race *ghiesbreghtii* more heavily flecked with black on wings than females. Races separated on plumage.

Habitat. Tropical and occasionally subtropical rain forest, up to 1400 m in Colombia; uses forest edge and also pastures with isolated trees. Regularly soars over the forest.

Food and Feeding. Reptiles (many snakes), amphibiae, caecilians, amphibians, small mammals, large insects and fish; one record of a toucan. In the Petén, well over half of identified prey items were reptiles, followed in numerical importance by mammals, birds, insects and amphibians. Hunts from a perch, often at the forest edge. Soars and perches conspicuously over the forest

Breeding. In Petén, courtship begins in Feb. with eggs laid in Mar (middle of dry season), fledging at beginning of rainy season; nests in Mar in Panama and Trinidad. Stick nest, average 50-90 cm wide, in tall tree, sometimes on bromeliads. 1 egg; incubation 34-36 days; 1 young fledged at 88 days. One fully-fledged immature, apparently of previous year's breeding effort seen begging for food near a nest; this suggests there may be an extended dependency period, as in other Neotropical raptors, resulting in breeding only every other year following a successful nesting effort. Breeding adult male used home range of 208 ha; a non-breeding bird used a home range of 46 ha.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES II. In no apparent danger: one of the commonest and most conspicuous forest raptors, occurring over a vast range; tolerates areas of disturbed forest. Apparently local in Colombia, where only known to be fairly common in extreme E. along R Orinoco.

Bibliography. Amadon (1964, 1982b), Blake (1977), Draheim (1993), Draheim & Barrera (1992), Draheim *et al.* (1991), French (1973, 1992), Herklots (1961), Hilty & Brown (1986), Lamm (1974), Meyer de Schauensee & Phelps (1978), Monroe (1968), Pinto (1964), Ridgely & Gwynne (1989), Sick (1985a, 1993), Slud (1964), Stiles & Skutch (1989), Terborgh & Weske (1975), Thiollay (1989a, 1989b), Voous (1969), Wetmore (1965).

161. Grey-backed Hawk

Leucopternis occidentalis

French: Buse à dos gris **German:** Graurückenbussard **Spanish:** Busardo Dorsigrís

Taxonomy. *Leucopternis occidentalis* Salvin, 1876, western Ecuador.

Has been considered a race of *L. albigollis*, to which it is closely allied; forms superspecies with *L. albigollis* and *L. polionota*. Monotypic.

Distribution. W Ecuador and adjacent NW Peru. Single record from E Andean slope now questioned by its authors.



Descriptive notes. 45-48 cm; female 660 g. Above blackish grey; head grey, nape streaked with white; tail white with broad black subterminal band. Iris dark brown, legs pale yellow. Separated from most congeners by tail pattern; from *L. albigollis williaminae* by grey head. Female similar, but slightly larger. Immature like adult, but brownish grey above rather than plumbeous; nape with dusky, not white, streaks. **Habitat.** Deciduous and evergreen forests, including cloud forest, generally at 100-1400 m, but also up to 2100. Avoids drier areas.

Food and Feeding. Only scattered anecdotal records available: land crabs, beetles, katy-

dids, frogs, snakes, lizards and small rodents. Seen hunting over streams.

Breeding. No nests known, but observations of display activity and birds with nesting material during the rainy season (Dec-Apr).

Movements. Sedentary.

Status and Conservation. ENDANGERED. CITES II. Massive deforestation affecting 90% of former range has reduced the population to only a few areas; largest are Machalilla National Park in Ecuador and Tumbes National Forest in Peru, neither of which is well protected; nor does Machalilla contain very suitable habitat. Some birds persist in very disturbed, fragmented forest mosaics in Ecuador.

Bibliography. Amadon (1964, 1982b), Best *et al.* (1993), Blake (1977), Collar & Andrew (1988), Collar *et al.* (1992), Dodson & Gentry (1991), King (1978/79), Meyburg (1986), Meyer de Schauensee (1982), Parker *et al.* (1982), Robbins & Ridgely (1990), Robbins *et al.* (1987), Wiedenfeld *et al.* (1985).

162. Mantled Hawk

Leucopternis polionota

French: Buse mantelée **German:** Mantelbussard **Spanish:** Busardo Blanquinegro

Taxonomy. *Buteo polionotus* Kaup, 1847, South America = São Paulo, Brazil.

Forms superspecies with *L. albigollis* and *L. occidentalis*; has been considered a subspecies of former. Monotypic.

Distribution. E Brazil (Alagoas and Bahia) S to E Uruguay and E Paraguay (Alto Paraná). Purported Argentinian distribution (in Misiones) apparently based on supposition, with no confirmed records or data.



Descriptive notes. 47-51 cm. Head, neck, upper back and entire underparts white; rest of upperparts and base of tail bluish slate; terminal half of tail white; white tips to secondaries and, more narrowly, to primaries. Iris brown, cere pale yellow, legs and feet pale orange-yellow. Tail pattern separates from congeners, especially *L. albigollis* and *L. lacemulata*. Female similar to male, but larger. Immature spotted or barred with white on lower back and dusky streaking on head and hindneck.

Habitat. Forests in tropical zone; typically in mountainous areas.

Food and Feeding. Some birds, small snakes and geckos, guinea pigs (*Kerodon rupestris*) and other small mammals recorded.

Breeding. No information available.

Movements. Presumably sedentary.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Status poorly known; rare or locally distributed; with massive deforestation going on throughout range, further surveys and careful monitoring of species highly desirable; preference for more mountainous regions will probably result in at least some suitable habitat remaining.

Bibliography. Albuquerque (1986), Amadon (1964, 1982b), Belton (1984), Blake (1977), Collar & Andrew (1988), King (1978/79), Meyburg (1986), Olrog (1985), de la Peña (1992), Pinto (1964), Ruschi (1979), Sick (1985a, 1993), Straube & Bomschein (1991).

163



ssp anthracinus



164



ssp gundlachii



165



ssp urubitinga

166



ssp ridgwavi



167



ssp uncinatus

ssp harrisi

168



169



ssp leucocephalus



ssp nigricollis



170

ssp melanoleucus



ssp australis



171



172



173

ssp plagiatu



173

ssp nitidus



ssp pallidus

PLATE 16

inches

14

cm

35

Genus *BUTEOGALLUS* Lesson, 1830

163. Rufous Crab-hawk

Buteogallus aequinoctialis

French: Buse buson German: Rotbauchbussard Spanish: Busardo-negro del Atlántico
Other common names: Aequinoctial Crab-hawk, Rufous Hawk

Taxonomy. *Falco aequinoctialis* Gmelin, 1788, Cayenne.

Genus allied to *Harpyhaliaetus*. Sometimes associated with *B. anthracinus* superspecies, but apparently more distantly related. Monotypic.

Distribution. Orinoco Delta in E Venezuela along coast to Paraná, S Brazil.



Descriptive notes. 42.5-46 cm; male averages 595 g, female 796 g. Head, throat and hind-neck sooty black; deep fuscous brown on wings and back with rufous edging; tail black, narrowly tipped white, with faint narrow whitish median band; below rufous with fine fuscous barring. Eyes brown, cere and feet yellow. Female similar, but larger. Immature mostly brown above, with tawny wing patches; tail greyish with obscure bands; below white streaked dusky, with thighs barred.

Habitat. Coastal lowland swamps, mangroves, wet savannas and river edges; predominantly in mangroves.

Food and Feeding. Mostly, or exclusively, crabs, e.g. *Ucides cordatus* and *Callinectes bocourti* in Surinam. Crabs caught after short dive from low perch; taken to stump, low branch or dry ground for consumption; birds sometimes use favoured spot.

Breeding. In Surinam, nests in rainy season. Twig nest, lined with leaves. Vocal and aerial display reported. Normally 1 egg, sometimes 2.

Movements. Sedentary; usually seen in pairs.

Status and Conservation. Not globally threatened. CITES II. Commonest raptor (within its range) in mangroves of South America. Status of no immediate concern, but restricted habitat makes it highly susceptible locally to any form of deterioration or loss of this habitat.

Bibliography. Amadon (1949, 1961c, 1982b), Blake (1977), Haverschmidt (1962), Meyer de Schauensee & Phelps (1978), Pinto (1964), Sick (1985a, 1993), Snyder (1966), Tostain *et al.* (1992).

164. Common Black Hawk

Buteogallus anthracinus

French: Buse noire German: Krabbenbussard Spanish: Busardo-negro Norteño
Other common names: (Lesser) Black Hawk; Cuban Black Hawk (*gundlachii*)

Taxonomy. *Falco anthracinus* Deppe, 1830, Veracruz, Mexico.

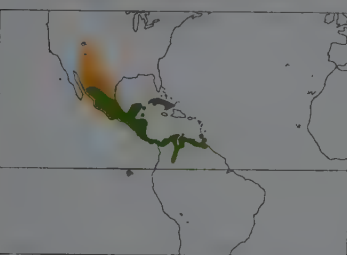
Taxonomy controversial: sometimes considered to include *B. subtilis*; race *gundlachii* may be valid species; races *gundlachii* and especially *utilensis* sometimes included in nominate; populations of St Vincent (Lesser Antilles) and SW USA sometimes awarded separate races, respectively *cancrivor* and *micronyx*. Forms superspecies with *B. subtilis*. Three subspecies currently recognized.

Subspecies and Distribution.

B. a. anthracinus (Deppe, 1830) - SW & S USA (S Utah and Arizona to Texas) through Central America to Panama and N Colombia, then along Caribbean coast to NW Guyana, Trinidad and St Vincent (Lesser Antilles); penetrates inland to Huila, Colombia.

B. a. gundlachii (Cabanis, 1855) - Cuba and I of Pines.

B. a. utilensis Twomey, 1956 - Cancún I and Cozumel I, off Yucatán; Utila I and Guanaja I, in Gulf of Honduras; and perhaps other adjacent islands.



Descriptive notes. 43-52 cm; male averages c. 793 g, female 1199 g. Blackish to deep fuscous brown overall, depending on race and plumage wear; very short tail has broad white band through middle and narrow white tip; underwing mottled with white at base of primaries. Cere, lores and long legs chrome yellow; cere can be white. Differs from smaller *B. subtilis* in wing markings, from larger *B. urubitinga* in tail pattern. Female similar to male, but averages larger. Immature dark brown above, with white to buff streaks and spots; below buff to ochraceous heavily streaked brown, with thighs finely barred; tail

has numerous narrow dark and pale bars. Race *gundlachii* smaller and generally browner, with whitish malar stripe; race *utilensis* intermediate between nominate race and *A. subtilis*.

Habitat. Tropical and lower subtropical zones, up to 500 m in Colombia, dense, mature riparian wooded areas dominated in N of range by mesquite and *Pithecellobium*, even occurring in hilly desert; mangroves (especially *gundlachii*) and tidal flats. On St Vincent affects mountain forest.

Food and Feeding. Reptiles and fish usually important, but diet varies between pairs in a population and from year to year, as dictated by changes in prey availability. In Durango, Mexico, 10% reptiles, 86% fish (of one species, *Maxostoma austrinum*), amphibians and invertebrates in small amounts, in coastal SE Mexico, almost exclusively crabs; on a beach in Costa Rica, a major predator of ghost crabs; elsewhere rodents. 1 bat and birds represented 6% of diet; Cuban population feeds heavily on crabs; also fish, rarely rodents and perhaps iguanas. Soars frequently, often in pairs, but usually hunts from a perch or on foot, an area will be surveyed for some time from a perch c. 15 m high, but most attacks initiated from closer to ground.

Breeding. Pair formation in Mar, in Cuba; laying in May, in S USA; nests Jan-Mar, in Panama; female in breeding condition in Jan, in Colombia. Bulky stick nest lined with twigs and always

trimmed with greenery; 5-33 m high in mangrove, palmetto, cypress or other tree. Acrobatic aerial courtship displays. 1-3 eggs (average 1.67 in Petén, Guatemala), laid at 2-3 day intervals; incubation 39 days, by both sexes; chick has grey down, with whiter head and breast; fledging 43-50 days. Density of 0-35 pairs/km of river along R Bavispe (NW Mexico). In coastal forest, territories well defined and very small (c. 15 ha).

Movements. Northernmost population of N Mexico and S USA leaves breeding area for winter, but further details lacking. Other populations not known to migrate, and presumed to be sedentary.

Status and Conservation. Not globally threatened. CITES II. Generally fairly common throughout much of range, e.g. Caribbean coast of Colombia; species in no apparent danger overall. In 1960's, was commonest hawk in suitable habitat in Honduras. Island races, with restricted ranges, naturally vulnerable to certain extent.

Bibliography. Abramson (1967), Amadon (1961c, 1982b), Biaggi (1983), Blake (1977), Carter & Wauer (1965), Daniels *et al.* (1989), Hilty & Brown (1986), Hiraldo, Delibes *et al.* (1991), Johnson (1990), Meyer de Schauensee & Phelps (1978), Monroe (1968), Palmer (1988), Ridgely & Gwynne (1989), Rodríguez-Estrella (1990), Rodríguez-Estrella & Brown (1990), Schnell (1979), Sherfy (1984), Sherrod (1978), Slud (1964), Stiles & Skutch (1989), Thollay (1980b), Tostain (1986b), Tostain *et al.* (1992), Voous (1969), Wauer & Russell (1967), Weimore (1965), Wol/kow (1985).

165. Mangrove Black Hawk

Buteogallus subtilis

French: Buse des mangroves German: Mangrovebussard Spanish: Busardo-negro del Pacífico
Other common names: Pacific Black Hawk

Taxonomy. *Urubitinga subtilis* Thayer and Bangs, 1905, Gorgona Island, Colombia.

Taxonomic status remains uncertain: until recently considered a race of *B. anthracinus*, but elevated to specific level based on apparent lack of hybridization with *anthracinus*; however, there may be contact in Panama where the forms are practically indistinguishable, making detection of hybridization very difficult. Forms superspecies with *B. anthracinus*. Three subspecies normally recognized.

Subspecies and Distribution.

B. s. rhizophorae Monroe, 1963 - Pacific coast of El Salvador and Honduras; probably from extreme SW Mexico (Chiapas) locally to Nicaragua.

B. s. bangsi (Swann, 1922) - Pacific coast of Costa Rica and Panama, including Pearl Is.

B. s. subtilis (Thayer & Bangs, 1905) - Pacific coast of Colombia (and offshore islands), Ecuador and adjacent extreme N Peru (Tumbes).



Descriptive notes. c. 39-47 cm. All sooty black; tail with one broad white median band; a pale morph occurs in birds which lack melanin. Somewhat smaller than *B. a. anthracinus*; base of primaries mottled with more white; usually more rufous mottling at base of secondaries. Female similar to male, but slightly larger. Immature similar to that of *B. anthracinus*, with more white and rufous in wings, making separation from *B. anthracinus* more difficult. Races distinguished by size and presence or absence of rufous in wings.

Habitat. Reportedly restricted to mangrove swamps and beach scrub; in Panama, birds will venture away from mangroves. May be confined to mangroves for breeding.

Food and Feeding. Primarily crabs, but also fish, sometimes as carrion. Feeding habits apparently similar to those of *B. anthracinus*.

Breeding. Unknown, but presumably similar to very closely allied *B. anthracinus*.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES II. Status poorly documented, partly due to taxonomic confusion. In places is fairly common, but few records for Colombia; common in Pearl Is, off Panama.

Bibliography. Amadon (1961c, 1982b), Davis (1972), Hilty & Brown (1986), Monroe (1963, 1968), Ridgely & Gwynne (1989), Slud (1964), Stiles & Skutch (1989), Weimore (1965).

166. Great Black Hawk

Buteogallus urubitinga

French: Buse urubu German: Schwarzbussard Spanish: Busardo-negro Urubitinga

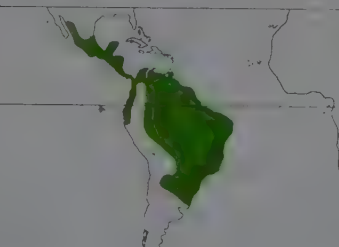
Taxonomy. *Falco urubitinga* Gmelin, 1788, northeastern Brazil.

Two subspecies recognized.

Subspecies and Distribution.

B. u. ridgwayi (Gurney, 1884) - Mexico (C Sonora and S Tamaulipas) S to W Panama.

B. u. urubitinga (Gmelin, 1788) - E Panama, W of Andes S to W Ecuador, and E of Andes E to the Guianas, Trinidad and Tobago, and S through E Bolivia and Brazil to Paraguay, Uruguay and N Argentina (Tucumán, Santiago del Estero, Santa Fe).



Descriptive notes. 51-64 cm; male 853-996 g, female 900-1250 g. Dull black overall; tail white with broad black subterminal bar. Legs very long, toes short. Iris dark brown to red, cere and legs dull yellow. Larger than congeners, with different tail pattern. Female similar to male, but larger. Immature dark brown, marked lightly or heavily with buff or cinnamon on head, hind-neck and upper back; below ochraceous, spotted and streaked with dark brown, thighs finely barred; tail and remiges narrowly barred. Race *ridgwayi* smaller, with two black bands in tail, and buff and underwing coverts finely barred white; cere greyish slate.

Habitat. Broad range of habitats from tropical to lower subtropical zones, from dry Chaco to rain forest, savanna with forest patches and gallery forest, and old pastures with scattered trees; usually near water. Regularly soars over forest.

Food and Feeding. Rodents, birds, fish, land crabs, amphibians and carrion; also fruit (*Spondias lutea*) in Brazil. In one study in Costa Rica, frogs were main prey; other items included basilisk lizards, grebe, dove and nestling tiger-heron (*Tigrisoma*). In Petén, Guatemala, of 106 prey items identified: 31% lizards (2 species), 28% snakes (c. 10 species), 14% birds, 8% anurans, 8% bats, 7% mammals; snakes were most important prey type by biomass. In Pantanal of SW Brazil, recorded chasing Plumbeous Ibis (*Theristicus caerulescens*) off nest, and then eating eggs. In forested areas, feeds both in canopy and on forest floor; also forages at forest edge, marshy areas and in more open country. Makes short flights between clumps of aquatic vegetation, where long legs help to catch prey in shallows.

Breeding. Most nests reported in rainy season: Mar-Apr in Panama; Aug in Venezuela; Oct in Argentina; in Petén, laying in latter part of dry season, with hatching near start of rainy season in May. Stick nest in trees, e.g. palms; in Argentina, nests on power poles, and also on top of nests of Monk Parakeet (*Myiopsitta monachus*). 1-2 eggs, but usually only 1 young reared; incubation c. 40 days; young seen perched near nest begging for food 7 months after fledging.

Movements. Primarily sedentary; individuals of N race may wander into Chocó of Colombia. **Status and Conservation.** Not globally threatened. CITES II. Very widely distributed and adapts well to man-modified habitats; no reason for concern at present. Among the commonest species at one forest in French Guiana, with estimated average density of at least 17 individuals/10,000 ha. Habit of nesting on power poles in Argentina sometimes causes problems.

Bibliography. Amadon (1982b), Belton (1984), Blake (1977), Brodie & Baness (1993), Contreras *et al.* (1990), Dickey & Rossem (1938), Gerhardt *et al.* (1992, 1993), Harris *et al.* (1991), Hilty & Brown (1986), Lewis & Timm (1991), Lowery & Dalquest (1951), Mader (1981), Meyer de Schauensee & Phelps (1978), Monroe (1968), Olmos (1990b), Olrog (1985), de la Peña (1992), Pinto (1964), Ruschi (1979), Sick (1985a, 1993), Slud (1964), Stiles & Skutch (1989), Thiollay (1989a, 1989b), Tostain *et al.* (1992), Trail (1987), Voous (1969), Wetmore (1965).

167. Savanna Hawk

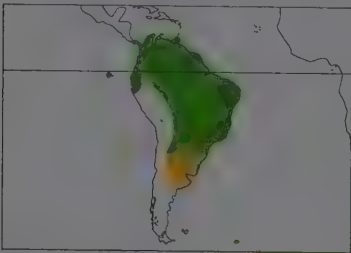
Buteogallus meridionalis

French: Buse roussâtre German: Savannenbussard Spanish: Busardo Sabanero

Taxonomy. *Falco meridionalis* Latham, 1790, Cayenne.

Often placed in monotypic genus *Heterospizias*, mainly due to longer legs and wings. Population of Paraguay, SE Brazil and Argentina has been awarded separate race, *rufulus*, but differs only in size, and not generally considered valid; Argentinian birds have alternatively been in equally dubious race *australis*. Monotypic.

Distribution. W Panama (Chiriquí) through tropical South America W of Andes to NW Peru, and E of Andes E to the Guianas and Trinidad, and S through Ecuador, E Peru, E Bolivia and Brazil to N Argentina (Tucumán, Córdoba and Santa Fe).



Descriptive notes. 46-60 cm; 825-1069 g. Head, neck and underparts rufous to cinnamon brown; hindneck streaked, back fuscous brown edged rufous; below finely barred black, except on throat; primaries and secondaries broadly edged black; tail black with narrow median band and narrow white tip. Iris reddish yellow to pale brown, cere pale yellow, legs pale orange yellow. Female similar to male, but larger. Immature sooty brown above, with prominent white eyestripe; mottled rufous on shoulder; below tawny buff streaked blackish on breast, and barred on belly and thighs; tail black with irregular banding.

Habitat. Tropical to subtropical zones, up to 1000 m in Colombia, in open country, wooded and palm savannas, swamplands, forest edge, riparian and mangrove forests; often near water.

Food and Feeding. Opportunistic, taking wide range of small mammals, birds, crabs, frogs, toads, lizards, snakes and large insects. In rainy season in Venezuela, semi-terrestrial freshwater crabs and also eels are very important prey. Said to hunt from low perches and plunge clumsily down onto prey, but significant number of birds in the diet of a Venezuela population suggest a more agile predator. Pirates food from other birds, including a stork. Feeds at grass fires, where will search on foot for toasted prey only a few metres behind the fire.

Breeding. Lengthy breeding season, with laying Feb-Sept (rainy season) in Venezuela; in S of range, nests in austral spring, with egg in Sept, and well feathered young in Nov, in Argentina. Stick nest, often in isolated tree. 1 egg; incubation 39 days; fledging 45-50 days; post-fledging dependency 4-7 months. Density in palm savanna was 1 pair/0.41 km². High rate of nest failure (52.9%), but re-nesting does occur, albeit not very successfully. Long post-fledging dependency and relatively high adult survivorship of 71% compensate for low nesting success.

Movements. Resident over most of range, with high degree of territory fidelity; apparently migratory in S, with very large individuals (S population) reported in Colombia during austral winter. Most common along Paraguay R in Jun, when probably attracted by more abundant prey associated with high water levels. Transition between migratory and resident populations in S undocumented.

Status and Conservation. Not globally threatened. CITES II. Apparently uncommon in Colombia, except in *llanos*. Generally common in savanna situations further S. Species seems secure, and numbers likely to increase as result of continuing deforestation.

Bibliography. Amadon (1964, 1982b), Belton (1984), Blake (1977), Gore & Gepp (1978), Hayes (1991), Hilty & Brown (1986), Mader (1982), Meyer de Schauensee & Phelps (1978), de la Peña (1992), Pinto (1964), Plotnick (1956), Ridgely & Gwynne (1989), Ruschi (1979), Sick (1985a, 1993), Tostain *et al.* (1992), Voous (1969), Wetmore (1965).

Genus *PARABUTEO* Ridgway, 1874

168. Harris' Hawk

Parabuteo unicinctus

French: Buse de Harris German: Wüstenbussard Spanish: Busardo Mixto
Other common names: Bay-winged Hawk

Taxonomy. *Falco unicinctus* Temminck, 1824, Boa Vista, western Minas Gerais, Brazil. Population of SW USA and NW Mexico has been recognized as distinct race, *superior*, but not generally accepted. Two subspecies normally recognized.

Subspecies and Distribution.

P. u. harrisi (Audubon, 1837) - SW USA (S California to Texas) through Mexico and Central America (except Belize and Honduras) to drier Pacific slope regions of W Colombia, Ecuador and Peru. *P. u. unicinctus* (Temminck, 1824) - NE Colombia and W Venezuela S through E Bolivia and C & NE Brazil (Maranhão and Ceará) to S Argentina (Río Negro) and SC Chile (Aisén).



Descriptive notes. 48-56 cm; male 725 g, female 834-1047 g. Blackish to deep sooty brown overall, with shoulders, thighs and underwing-coverts bright chestnut rufous; underparts flecked white, thighs barred dusky; long black tail white at base and tip, uppertail- and undertail-coverts also white. Iris brown, cere and legs bright yellow. Female similar to male, but larger. Immature buffy white below, boldly streaked and spotted fuscous, sides and thighs barred rufous; head streaked buff to cinnamon; shoulder rufous with black variegation; tail more or less finely barred fuscous. Race *harrisi* lacks white markings on breast and belly.

Habitat. Seasonally dry desert, Chaco and savanna, sometimes in swampy areas, often near large water bodies in more arid habitats; up to 1500 m in Colombia, to 1000-1900 m in open chaparral in Chile. **Food and Feeding.** Mostly mammals, including large prey, e.g. rabbits and, to lesser extent, larger black-tailed jackrabbits (*Lepus californicus*); also birds, e.g. flickers, guans, rails. Seems to be opportunistic generalist, taking different prey species in quantities roughly proportional to relative local abundance of prey: in Arizona (USA), 60% ground squirrels, 28% Gambel's Quail (*Callipepla gambelii*), and 11% reptiles; another site in Arizona, 74% mammals, 17.5% birds, and 8.5% lizards; C Chile, 92% small mammals, some lizards and snakes and very few birds; and near Santiago, C Chile, 67% mammals (including European rabbit), 21% birds, 7% herps, and 3% insects. Apparently does not take snakes; one record of a group feeding on fish refer to carrion. Co-operative hunting for larger prey (see page 71).

Breeding. Co-operative breeding in some populations of S USA, but not recorded elsewhere (see page 75). Nesting Jun-Jul, in Colombia; recently fledged young Feb and Jul, in Venezuela; nestlings Aug-Dec, in Argentina; extended breeding season in S USA, starting Feb-Nov. Stick nest lined with weeds, shoots, leaves, grass and Spanish moss; built in mesquite, ironwood or other trees, shrubs, saguaro cactus, or man-made structures. Average 3 eggs (2-4); incubation 33-36 days; chicks have pale brown down; fledging c. 40 days; young stay near nest for 3-4 months after fledging, and may integrate into next breeding cycle, dispersing from natal territory after 3 years. In New Mexico (USA), 29-70% of pairs re-nested in late summer or early autumn, even after successful spring breeding attempts; second clutch can be laid before young from first nest fledge. Extended breeding season in S USA may be insurance against unpredictability of climate and prey abundance, as violent summer storms during period of peak prey availability often lead to nest failure. Young of co-operative groups do not have higher survival rate, but are slightly larger than those raised by pairs; groups have higher failure of eggs, but re-nest and eventually have similar productivity to pairs. Retention of young in group may be stepping stone to polyandry. Recorded density of 0.5 nesting groups/km²; Arizona population in prime area reached density of 1 breeding group/5 km². Conflicting reports on territoriality: non-territorial; adjacent groups wander through neighbours' ranges; groups defend territories. During breeding season, group members stay within 0.8 km from nest or less, and rarely encounter neighbouring groups; winter aggregations (individuals from adjacent territories and wandering birds) form in between territories.

Movements. Somewhat confused. In general sedentary, but may be nomadic at limits of range; Texas population seems to shift in response to fluctuating population levels of prey. Individuals recorded on migration in Panama, but population as close as NW Costa Rica is resident; "migrants" in Panama may be stragglers, perhaps birds recently fledged further N.

Status and Conservation. Not globally threatened. CITES II. Common in many parts of extensive range; broad tolerance in terms of both habitat and food suggest species secure. Fairly common in S USA; common in NE Colombia; not uncommon locally in C and SE Brazil; locally common in W Ecuador. Has declined in parts of S Argentina where strychnine used by sheep ranchers. Small population of SE California (USA) has been re-established by means of reintroduction.

Bibliography. Amadon (1982b), Bednarz (1986, 1987a, 1987b, 1988a, 1988b), Bednarz & Ligon (1988), Belton (1984), Blake (1977), Brannon (1980), Contreras *et al.* (1990), Dawson (1988), Dawson & Mannan (1991a, 1991b), Ellis *et al.* (1993), Ellis & Whaley (1979), Fjeldså & Krabbe (1990), Gaudin (1993), Griffin (1976), Hammerstrom & Hammerstrom (1978), Hauke (1971), Hilty & Brown (1986), Jakde & Gatz (1984), Jakšic & Delibes (1987), Jakšic & Jiménez (1986), Jakšic, Greene & Yáñez (1981), Jakšic, Jiménez *et al.* (1992), Jakšic, Yáñez & Schlatter (1980), Jiménez & Jakšic (1993), Johnson (1990), Johnson (1965), LeSassier & Williams (1959), Mader (1975a, 1975b, 1977, 1978, 1979a), Mays *et al.* (1991), Meyer de Schauensee & Phelps (1978), Olrog (1979), Pache (1974), Palmer (1988), Pennycook *et al.* (1989), de la Peña (1992), Pinto (1964), Radke & Klimoszewski (1977), Ridgely & Gwynne (1989), Sherrod (1978), Sick (1985a, 1993), Slud (1964), Stiles & Skutch (1989), Tucker & Heine (1990), Vleck *et al.* (1991), Wetmore (1965), Whaley (1986).

Genus *BUSARELLUS* Lesson, 1843

169. Black-collared Hawk

Busarellus nigricollis

French: Buse à tête blanche German: Fischbussard Spanish: Busardo Colorado
Other common names: Collared Fishing Hawk/Buzzard, Chestnut Hawk

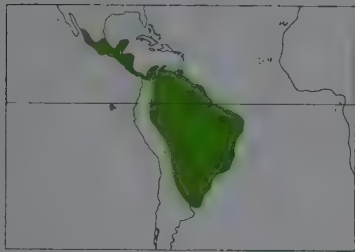
Taxonomy. *Falco nigricollis* Latham, 1790, Cayenne.

Allied to *Buteogallus* and *Parabuteo*. Two subspecies recognized.

Subspecies and Distribution.

B. n. nigricollis (Latham, 1790) - C Mexico (Sinaloa and Veracruz) S through Central America to Amazonia, W to E Ecuador and E Peru, E to the Guianas and Trinidad, and S through E Bolivia to S Brazil.

B. n. leucocephalus (Vieillot 1816) - Paraguay, Uruguay and N Argentina (S to Salta, Santa Fe and Corrientes).



Descriptive notes. 45.5-49.5 cm; male 695 g, female 796 g. Broad wings and fairly short tail; head and neck white to buff, streaked above; black band across upper breast; rest of body bright rufous cinnamon; black shaft streaks on back; primaries and tail black, tail basally barred rufous. Eye reddish brown, cere black, legs and feet bluish white. Female similar, but larger. Immature fuscous brown above, spotted and barred rufous; breast tawny with fuscous streaks, belly sooty brown to rufous, finely barred fuscous. Race *leucocephalus* larger, with whiter head.

Habitat. Tropical zone, near fresh or brackish water; open country to dense tropical rain forest along larger rivers; up to 500 m in Colombia.

Food and Feeding. Mostly fish, but also some aquatic insects (Belostomatidae) and snails; perhaps, exceptionally, lizards and rodents. Sometimes soars, but most hunting from perch; usually drops onto prey in shallows, or amongst aquatic vegetation; spiny feet aid in grabbing fish.

Breeding. Very poorly known. Laying in Jun-Sept in Surinam, Apr in Guyana, Aug/Sept in Paraguay; nest in Sept. El Salvador; female in breeding condition in Apr. Colombia. Stick nest (conflictingly described as large or small) in mangroves or tall trees; apparently trimmed with greenery. 1 egg. No further information available.

Movements. Mainly sedentary, but may move nomadically in response to changing water levels; most common along R Paraguay in June.

Status and Conservation. Not globally threatened. CITES II. Quite common in appropriate habitat in many parts of extensive range. Apparently declining in Panama, due to drainage of wetlands; same may well be true elsewhere.

Bibliography. Amadon (1964, 1982b), Belton (1984), Blake (1977), Contreras *et al.* (1990), Gore & Gepp (1978), Haverschmidt (1962, 1968), Hayes (1991), Hilty & Brown (1986), Meyer de Schauensee & Phelps (1978), Monroe (1968), de la Peña (1992), Pinto (1964), Ridgely & Gwynne (1989), Sick (1985a, 1993), Slud (1964), Stiles & Skutch (1989), Tostain *et al.* (1992), Voous (1969), Wetmore (1965).

Genus GERANOAEETUS Kaup, 1844

170. Black-chested Buzzard-eagle

Geranoaetus melanoleucus

French: Buse agüia

German: Agula

Spanish: Aguila Mora

Other common names: Black/Grey Buzzard-eagle/Eagle-buzzard/Eagle

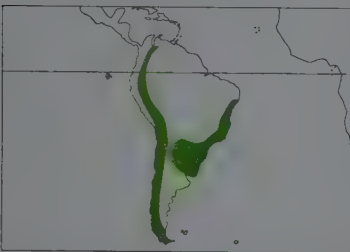
Taxonomy. *Spizaetus melanoleucus* Vieillot, 1819, Paraguay.

Mistakenly placed in *Buteo* formerly; closer to *Buteogallus* and *Leucopternis*, and clearly merits separate generic status. Two subspecies recognized.

Subspecies and Distribution.

G. m. australis Swann, 1922 - NW Venezuela (Mérida Andes) through W South America S to Tierra del Fuego.

G. m. melanoleucus (Vieillot, 1819) - S & E Brazil (Alagoas, Rio de Janeiro and São Paulo) to Paraguay, E Argentina (N of Buenos Aires) and Uruguay.



Descriptive notes. 62-80 cm; 2000 g; wingspan 175-200 cm. Wings very long and broad; tail short and wedge-shaped. Head and back bluish to slate black or deep sooty brown; black tail tipped narrowly greyish white; shoulders ashy grey finely barred black; breast black, and rest of underparts white, with or without fine dark barring. Female much larger. Immature deep brown to blackish; lacks grey shoulder of adult; below white to tawny or buff, breast heavily streaked black, belly and thighs barred; transition to adult plumage takes several years. Race *australis* smaller; always has some barring on white undersides.

Habitat. Chiefly mountains in N of range, at 1600-3500 m in Colombia, occasionally to 4600 m elsewhere. Ventures into lowlands in S Chile and Argentina, from Buenos Aires S to Tierra del Fuego; grassy foothills, valleys, shrub-steppe and *Nothofagus* woodland; occurs up to 2200 m in Chile.

Food and Feeding. Mostly mammals, accounting for 95% of prey items reported, especially degu (*Octodon degus*) and European rabbit (*Oryctolagus cuniculus*); latter amounted to 44% of prey items, 82% of biomass in one study. Also some birds, e.g. Burrowing Owl (*Speotyto cunicularia*) and carrion; seasonally insects, a few snakes and lizards. Will take fairly large prey, e.g. Chilean Tinamou (*Nothoprocta perdicaria*), guans (*Penelope*) grey fox (*Dusicyon*) and Patagonian hog-nosed skunk (*Conepatus*). Most active mid-morning and mid-afternoon; except during winter, most time spent soaring, often in pairs, both on thermals and along north- and west-facing slopes and ridgetops that produce best updrafts, rather than being attracted to highest concentrations of prey or sparser vegetation, where prey might more easily be spotted.

Breeding. Breeding throughout year in Ecuador; nestlings Nov-Jan in Chile and Argentina, May and Aug in Peru, Mar-Jul in Venezuela; young in Apr and Jul, with recent fledgling also in Jul, in Colombia. Nests on cliffs, often very high, when available; in lower areas, stick nest in top of tall tree, if no trees, on cacti, lower bushes or even reportedly on the ground; nest c. 85 cm in diameter; will reuse nest, but often builds new one, so several may be found within 150 m of occupied site. Courtship flights; copulation over a period of at least 2 weeks, 1-3 eggs (usually 2); incubation c. 30 days; down of chicks thought to be white.

Movements. No indication of any movements.

Status and Conservation. Not globally threatened. CITES II. Generally fairly common; e.g. numerous in region of Torres del Paine National Park, S Chile. Range expanding in Brazil into decimated Atlantic forest in Alagoas. Declines reported in S Argentina, in areas where strychnine used by sheep ranchers.

Bibliography. Amadon (1963, 1982b), Barros (1967), Belton (1984), Blake (1977), Contreras *et al.* (1990), Donzar, Ceballos *et al.* (1993), Fjeldså & Krabbe (1990), Gonnard *et al.* (1957), Gore & Gepp (1978), Houssé (1926, 1945),

Humphrey, Bridge *et al.* (1970), Humphrey, Péfaur & Rasmussen (1993), Iriarte *et al.* (1990), Jaksic & Delibes (1987), Jaksic & Jiménez (1986), Jaksic, Greene & Yáñez (1981), Jaksic, Jiménez *et al.* (1992), Jiménez & Jaksic (1989, 1990b), Johnson (1965), Lehmann (1945), Meyer de Schauensee & Phelps (1978), Olog (1979), Pavez *et al.* (1992), Pearson & Ralph (1978), de la Peña (1992), Pinto (1964), Schlatter, Yáñez & Jaksic (1980), Schoonmaker (1984), Sierra (1986), Teixeira *et al.* (1988), Vuilleumier (1985).

Genus HARPYHALIAETUS Lafresnaye, 1842

171. Black Solitary Eagle

Harpyhaliaetus solitarius

French: Buse solitaire

German: Einsiedleradler

Spanish: Aguila Solitaria

Other common names: Solitary Eagle(!)

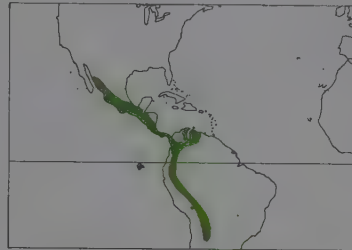
Taxonomy. *Circaetus solitarius* Tschudi, 1844, Río Chanchamayo, Junín, Peru.

Closely allied to *Buteogallus*. Formerly considered race of *H. coronatus*. Two subspecies recognized.

Subspecies and Distribution.

H. s. sheffleri (van Rossem, 1948) - locally in highlands from W Mexico (Sonora) to Panama.

H. s. solitarius (Tschudi, 1844) - locally from Colombia (Santa Marta Mts) E to N Venezuela and S through humid Andes to NW Argentina; also occurs in the Guianas, where limits of range virtually unknown.



Descriptive notes. 66-71 cm; 3000 g. Wings long and broad. All dark slate grey; short crest tends to be inconspicuous; rather short tail has bold white median band and white tip. Cere, legs and feet bright yellow. Female larger, with brownish wash and feather edgings. Immature dark brown above, with head and neck heavily streaked white, feathers of back tipped rufous; below yellowish white streaked black or fuscous, with almost complete blackish breastband; thighs fuscous. Race *sheffleri* larger in all dimensions, and darker grey on head, breast and mantle.

Habitat. Forested mountain slopes and cloud

forest. Tropical deciduous forest in Mexico at 750-2500 m, with one sighting at 200 m in Colombia. **Food and Feeding.** Very few data. Mostly snakes: one chachalaca (*Orealis*) in a nest in Sonora (Mexico).

Breeding. Very poorly known. Young in nest in May-Jun in Mexico. Stick nest in crotch of tall tree: one nest only 1 m off the ground; nest in Sonora in huge Mexican yellow pine (*Pinus ponderosa*), on steep slope of wooded canyon. Nests trimmed with greenery, 70-100 cm wide, c. 30 cm deep. Only 1 egg reported.

Movements. Presumably sedentary.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Status very poorly known; apparently rare throughout its broad latitudinal range. In no immediate danger, but surveys and research required.

Bibliography. Amadon (1949, 1982b), Best & Clarke (1991), Best *et al.* (1993), Blake (1977), Clinton-Eitner (1986, 1991), Collar & Andrew (1988), Contreras *et al.* (1990), Fjeldså & Krabbe (1990), Harrison & Kiff (1977), Hilty & Brown (1986), Meyer de Schauensee & Phelps (1978), Monroe (1968), Morales-Peréz & Navarro-Sigüenza (1991), de la Peña (1992), Ridgely (1980), Ridgely & Gwynne (1989), Robbins & Ridgely (1990), Schulenberg & Parker (1981), Slud (1964), Smith (1982), Stiles & Skutch (1989), Thiollay (1985a), Vamini (1989), Wetmore (1965).

172. Crowned Solitary Eagle

Harpyhaliaetus coronatus

French: Buse couronné

German: Zaunadler

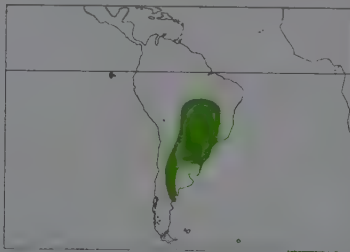
Spanish: Aguila de Azara

Other common names: Solitary Eagle(!), Crowned Eagle(!)

Taxonomy. *Harpyia coronata* Vieillot, 1817, Paraguay.

Closely related to *Buteogallus*. Sometimes considered to include *H. solitarius*. Monotypic.

Distribution. E Bolivia (Santa Cruz), W Paraguay and S Brazil (S from Mato Grosso and Goiás) to S Argentina (Mendoza and Río Negro); no definitive records from Uruguay, where probably occurs.



Descriptive notes. 75-85 cm (in one account only 66 cm); 2950 g. Broad wings, short tail and long legs; long, slightly darker occipital crest. Larger and paler than *H. solitarius*, with prominent crest. More or less uniform dark grey or ashy brown; tail black with white band and tip. Iris reddish brown, cere and legs yellow. Female similar, but averages larger. Immature brownish above, with pale cream supercilium and whitish streaking below; long crest as in adults.

Habitat. Most records deep into dry shrub Chaco and *caatinga*, and in moist Pantanal and palm savanna; in contrast, sometimes

claimed to be bird of thin woodland, forest and forest edge.

Food and Feeding. Not well documented. Takes armadillos and apparently also weasels, rodents, reptiles, birds (tinamous) and carrion (sheep, armadillos). Somewhat crepuscular, feeding on skunks (*Conepatus*) "and other sluggish animals". Hunts from low perches. Short toes are typical of a snake-eater, which is not incompatible with some of prey types recorded.

Breeding. Egg in Oct, young in May. Nest is platform of sticks c. 120 cm wide, 30 cm deep. One nest in Argentina built on top of Monk Parakeet (*Myiopsitta monachus*) colony. 1 egg. No further information available.

Movements. Mainly sedentary, but densities seem to decrease in southernmost portion of range during austral winter.

Status and Conservation. VULNERABLE. CITES II. Very poorly known. Occurs over large area, but at very low densities. Little hard evidence available on populations and trends; further documentation required, to permit adequate assessment of conservation status. There are a few records from protected areas, including Emas and Brasília National Parks, in Brazil, and Beni Biosphere Reserve, in Bolivia.

Bibliography. Albuquerque (1986), Amadon (1949, 1982b), Belton (1984), Blake (1977), Canevari *et al.* (1991), Cheber (1989), Collar & Andrew (1988), Collar *et al.* (1992), Contreras *et al.* (1990), Hayward (1967), Kratter *et al.* (1993), Olog (1985), de la Peña (1992), Remsen & Traylor (1989), Sick (1985a, 1993).

Genus *BUTEO* Lacépède, 1799

173. Grey Hawk

Buteo nitidus

French: Buse cendrée

German: Zweifindenbussard

Spanish: Busardo Gris

Other common names: Shining Buzzard-hawk; Grey-lined Hawk (*nitidus*); Mexican Goshawk (*plagiatus*)

Taxonomy. *Falco nitidus* Latham, 1790, Cayenne.

Sometimes placed in *Asturina*, partly due to distinctive moult pattern; appears to form clade with *B. magnirostris*, *B. ridgwayi* and *B. lineatus*, and this group may be more closely allied to *Leucopternis* than to *Buteo*. Race *plagiatus* sometimes awarded specific status, due to differences in size and plumage, but evidence remains rather weak. Four subspecies usually recognized.

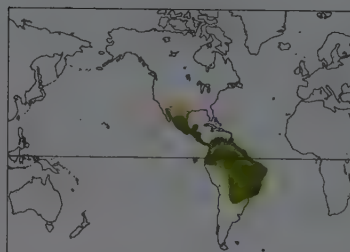
Subspecies and Distribution.

B. n. plagiatus (Schlegel, 1862) - SW USA (Texas to New Mexico) to NW Costa Rica.

B. n. costaricensis (Swann, 1922) - SW Costa Rica to N Colombia and W Ecuador.

B. n. nitidus (Latham, 1790) - E Colombia and E Ecuador, E to Venezuela and the Guianas, and S through Amazonian Brazil to N Maranhão.

B. n. pallidus (Todd, 1915) - SC Brazil (Piauí to Rio de Janeiro and Mato Grosso) and E Bolivia, S to Paraguay and NC Argentina (Tucumán and Chaco).



Descriptive notes. 38-43 cm; male 465 g, female 554 g. Grey overall, with or without obscure fine dark grey barring above and fine white barring below; tail black with 1-2 prominent white bands. Eye yellow or dark brown, cere and legs yellow. Female averages slightly larger. Immature blackish brown above, with white and buff mottling; below buffy white, with brown streaks on breast, spots on belly; tail brown with darker bands and whitish tip. Races separated on size, shade of grey, and presence or absence of barring.

Habitat. Adaptable: lowland tropical to subtropical zones, from rain forest edge and disturbed forest to arid, open country; up to 600 m in Colombia, to 1200 m in Panama.

Food and Feeding. Mostly lizards and small snakes; birds, including small species of both understorey and canopy, and a parakeet (*Aratinga*); also rodents, large Orthoptera and beetles. Soars for short periods, but usually hunts from a perch; agile hunter in forest, taking lizards from branches. More powerful and faster than *B. magnirostris*.

Breeding. Season Jan-May in Colombia and Venezuela; Feb in Panama and Surinam; Apr in Trinidad; laying May with fledging Jul in S USA, earlier in Mexico. Relatively small stick nest lined with sprigs, high in tree at forest edge, or more isolated, or in low thorny mesquite. Aerial courtship, with stoops from great heights (up to 500 m) and mock chases. Usually 2 eggs (1-3); more than 1 young can be raised; incubation 32 days; chicks have white down, greyish above fledging c. 42 days. Aggressively drives other raptors from nest area.

Movements. Generally sedentary, but mostly migratory in N limit of range. Guatemalan birds resident all year round.

Status and Conservation. Not globally threatened. CITES II. Generally widespread and relatively numerous. Uncommon and local in Arizona (USA), with total population of c. 45 pairs; uncommon to fairly common in Colombia. Adaptable, using variety of habitats.

Bibliography. Amadon (1982b), Blake (1977), French (1973), Friedmann & Smith (1955), Gibbs & Gibbs (1975), Haverschmidt (1962), Hilty & Brown (1986), Hubbard (1974), Johnsgard (1990), Meyer de Schauensee & Phelps (1978), Millsap (1986), Monroe (1968), Oberholser (1974), Palmer (1988), de la Peña (1992), Pinto (1964), Ridgely & Gwynne (1989), Rodríguez-Estrella & Brown (1990), Sherrod (1978), Short (1974), Slud (1964), Snyder & Wiley (1976), Stensrude (1975), Stiles & Skutch (1989), Stresemann & Stresemann (1960), Thiollay (1980b), Vannini (1989), Voous (1969), West (1975), Wetmore (1965), Zimmerman (1965, 1976b).

ssp *magniplumis*

174

ssp *saturatus*ssp *gracilis*ssp *lineatus*ssp *texanus*

174

ssp magnirostris

176

177

ssp *platypterus**ssp cubanensis*

175

ssp *extimus*ssp *elegans*

178

ssp *brachyurus*

179

ssp fuliginosus

179

180

pale morph

dark morph

pale morph

181

dark morph

pale morph

dark morph

ssp albicaudatus

reddish morph

182

ssp colonus

183

174. Roadside Hawk

Buteo magnirostris

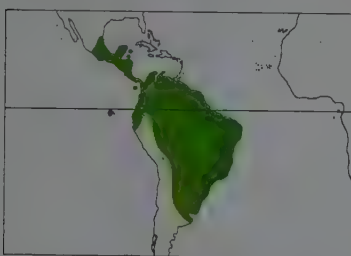
French: Buse à gros bec German: Wegebussard Spanish: Busardo Caminero
Other common names: Insect Hawk, Tropical Broad-winged Hawk, Large-billed Hawk

Taxonomy. *Falco magnirostris* Gmelin, 1788, Cayenne.

Sometimes placed in genus *Rupornis*, or alternatively in *Asturina*. Appears to be closely allied to *B. ridgwayi*, *B. lineatus* and *B. nitidus*, all of which may be more closely tied to *Leucopternis* than to *Buteo*. Many more races have been recognized: race *griseocauda* includes *argutus*, *direptor*, *xantusi* and *petersi*; race *magnirostris* includes *insidiatrix* and *ecuadoriensis*; race *occiduus* includes *inca*; and race *pucherani* includes *gularis*. Twelve subspecies recognized.

Subspecies and Distribution.

- B. m. griseocauda* Ridgway, 1873 - Mexico (S from Colima, Nuevo León and Tamaulipas, except Yucatán and Tabasco) S to NW Costa Rica and W Panama (Chiriquí).
- B. m. conspectus* (Peters, 1913) - SE Mexico (Tabasco and Yucatán Peninsula) and N Belize.
- B. m. gracilis* (Ridgway, 1885) - Cozumel I and Holbox I, near Yucatán (Mexico).
- B. m. sinuohonduri* Bond, 1936 - Bonacca I and Ruatan I, off Honduras.
- B. m. petulans* van Rossem, 1935 - SW Costa Rica and Pacific slope of W Panama to R Tuira, and adjacent islands.
- B. m. alius* (Peters & Griscom, 1929) - San José and San Miguel, in Pearl Is (Gulf of Panama).
- B. m. magnirostris* (Gmelin, 1788) - Colombia S to W Ecuador, E to Venezuela and the Guianas, and S to Amazonian Brazil (R Madeira E to Atlantic coast).
- B. m. occiduus* (Bangs, 1911) - E Peru, W Brazil (S of Amazon, W of R Madeira) and N Bolivia.
- B. m. saturatus* (P. L. Slater & Salvin, 1876) - Bolivia, through Paraguay and SW Brazil (SW Mato Grosso) to W Argentina (S to La Rioja).
- B. m. nattereri* (P. L. Slater & Salvin, 1869) - NE Brazil S to Bahia.
- B. m. magniplumis* (Bertoni, 1901) - S Brazil, N Argentina (Misiones) and adjacent Paraguay.
- B. m. pucherani* (J. & E. Verreaux, 1855) - Uruguay and NE Argentina (S to Buenos Aires Province).



Descriptive notes. 33-41 cm; male 251 g, female 303 g (Surinam). Rufous patch at base of primaries conspicuous in flight. Plumage varies considerably over large range: head, upperparts and upper breast grey to greyish brown, or deep chocolate brown to blackish above, with breast tawny or cinnamon rufous; belly barred with various combinations of white, tawny, grey and brown; tail grey to rufous, with 4-5 broad black bands and white tip. Iris yellow to orangish red, cere dull orange to yellow, legs dull orange to bright yellow. Female similar, but larger. Immature streaked white or tawny on neck and upper back; underparts white to buff, streaked

on breast and barred on belly with variable shades of brown. Races separated on plumage coloration and size, with largest forms in S of range.

Habitat. Very catholic in taste: quite common in most lowland tropical to subtropical habitats, except primary forest, desert and open plains; frequents forest edge, open forest, disturbed areas in second growth, savanna with gallery forest, and scattered patches of forest; even in large cities in Brazil, if enough trees available. Never found in interior of large patches of dense forest. Reported in both moist and dry forests in Colombia; in C Amazonia very rare or absent from unbroken *terra firme* forest. Occurs up to 2500 m in Colombia.

Food and Feeding. Mainly insects, reptiles and small mammals. A fairly typical buteonine generalist: in Argentina, 81% of samples included insects (mostly Orthoptera), 25% amphibians, 12% rodents, and 12% miscellaneous, including fish; in Surinam, mostly lizards, also frogs, snakes and large insects, but no evidence of birds in diet; in Petén (Guatemala), rats, lizards, birds and snakes in roughly equal proportions. Usually catches prey by perch-hunting from prominent branch, fence post, etc. Feeds on insects fleeing army-ant swarms; also along line of grass fires, sometimes singeing its flight-feathers so much as to render it nearly flightless.

Breeding. Nesting Mar-Jun (middle to late dry season) in Petén (Guatemala); birds in breeding condition Mar-May in Belize; Apr-Aug in Colombia and Venezuela (rainy season); Nov-Dec in Argentina. Very conspicuous and vocal around nest, with aerial display and courtship above nest-site. Fairly bulky stick nest 20-46 cm wide, 6-36 cm deep, lined with leaves; placed near top of tree, sometimes in bromeliads. Usually 1 egg in Venezuela, 2 eggs in Mexico, average 1-7 eggs from 3 clutches in Petén; incubation c. 37 days, beginning with first egg. Will renest after failed attempt.

Movements. No evidence of any movements.

Status and Conservation. Not globally threatened. CITES II. Widespread and generally very common; commonest hawk in wide variety of habitats throughout much of extensive range, e.g. Brazil, most of Colombia, and generally throughout much of Amazonia.

Bibliography. Aguilar-Rodríguez (1993), Belton (1984), Belzter (1990a), Blake (1977), Contreras *et al.* (1990), Feldsá & Krabbe (1990), Gore & Gepp (1978), Haverschmidt (1962), Hilty & Brown (1986), Howell (1972), Mader (1981), Marroquín & Moreno (1992), Meyer de Schauensee & Phelps (1978), Monroe (1968), Palmer (1988), de la Peña (1992), Pinto (1964), Ridgely & Gwynne (1989), Rowley (1984), Russell (1964), Sick (1985a, 1993), Slud (1964), Stiles & Janzen (1983), Stiles & Skutch (1989), Thiollay (1980b), Tostain *et al.* (1992), Vannini (1989), Wetmore (1965).

175. Red-shouldered Hawk

Buteo lineatus

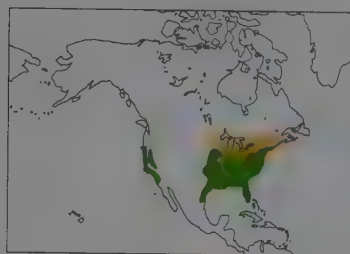
French: Buse à épaulettes German: Rotschulterbussard Spanish: Busardo Homborrrojo
Other common names: Red-shouldered Buzzard, Red-bellied Hawk

Taxonomy. *Falco lineatus* Gmelin, 1788, Long Island, New York.

Sometimes placed in *Asturina*. Apparently close to *B. ridgwayi*, *B. magnirostris* and, to lesser extent, *B. nitidus*. Five subspecies normally recognized.

Subspecies and Distribution.

- B. l. elegans* Cassin, 1856 - S Oregon (NW USA) to N Baja California (Mexico).
- B. l. lineatus* (Gmelin, 1788) - E North America, from S Canada to C USA.
- B. l. texanus* Bishop, 1912 - S Texas (USA) to Veracruz (CE Mexico).
- B. l. alleni* Ridgway, 1885 - SC Texas to South Carolina and N Florida.
- B. l. eximius* Bangs, 1920 - Florida and Florida Keys.



Descriptive notes. 43-61 cm; male averages 550 g, larger female averages 701 g; wingspan 90-127 cm. Medium-sized, tan to rufous woodland buzzard, with bold black and white pattern on wings and tail. Juvenile brown to tannish, with streaked underparts. Races differ in coloration and, to lesser extent, size.

Habitat. Mature lowland mixed deciduous-coniferous woodlands with nearby open water, clearings and rivers. In W USA shows high adaptability to human-altered habitats, even moving into urban areas.

Food and Feeding. Varied; takes small mammals, reptiles, birds (including nestlings), am-

phibians and insects. Content varies regionally, but overall invertebrates c. 55% and lower vertebrates 21% by frequency. Hunts mainly by direct search in flight, but also by still-hunting from perches. In Missouri (USA) 22% of time spent hunting in forests c. 25 m from water.

Breeding. Laying mainly Apr-May in Canada; Feb-Jun in California; Jan-Jun in Texas and Florida. Solitary. Stick nest in deciduous tree (90%) or conifer, c. 50 m from water in E North America; exotic eucalyptus favoured in S California, cabbage palmetto in Florida; nest lined with greenery. 2-5 eggs in N, 2-3 eggs in Texas; incubation c. 33 days; chicks have pale buffy white down, with black bill; fledging c. 45 days, in California where fledgling fed by adults for 8-10 weeks. Usually breeds first at 2 years, but some females breed at 1 year old. Oldest ringed bird 19 years 11 months; first year mortality c. 58%. Fledging success of c. 1.3-1.8 young per attempt.

Movements. N populations migrate to winter from C USA, where populations resident, to NE Mexico. Autumn migration from mid-Sept to Oct. Spring movement may start late Feb or Mar, with most pairs back at nests by middle to late Mar. In California and Florida, birds remain on breeding territory all year round.

Status and Conservation. Not globally threatened. CITES II. May have undergone slight overall decline since 1946; thought to be result of alterations and loss of habitat; Christmas Bird Counts show winter populations have declined, except in California. Range expansion out of California into S Oregon; in California increasingly adapted to urban settings.

Bibliography. Bednarz & Dinsmore (1981), Bloom (1989), Bloom *et al.* (1993), Bock & Lephien (1977), Brown, W.H. (1971), Campbell (1975), Castrale (1991), Cohen (1970), Friedmann (1950), Glinski (1982), Harlow & Brown (1989), Henny *et al.* (1973), Johnson (1990), Johnson & Peeters (1963), Kiltie (1987), Kimmel & Fredrickson (1981), McCrary (1981), McCrary & Bloom (1984a, 1984b), Mitchell & Millisap (1990), Morris & Lemon (1983), Palmer (1988), Parker, M.A. (1986), Portnoy & Dodge (1979), Snyder & Snyder (1991), Snyder & Wiley (1976), Stewart, R.E. (1949), Titus & Mosher (1981), Titus *et al.* (1989), Wilbur (1973), Wiley (1975).

176. Ridgway's Hawk

Buteo ridgwayi

French: Buse de Ridgway German: Haitibussard Spanish: Busardo de la Española

Taxonomy. *Rupornis ridgwayi* Cory, 1883, Santo Domingo.

Appears closely allied to *B. nitidus*, *B. magnirostris* and especially *B. lineatus*; this group perhaps more closely tied to *Leucopternis* than *Buteo*. Monotypic.

Distribution. Hispaniola and several adjacent islets.



Descriptive notes. 35-40 cm. Chestnut upper-wing-coverts, different tail pattern and lack of rufous in primaries separate from *B. magnirostris*; heavier claws and feet. Above greyish brown with bright rusty "shoulder"; head and neck grey, throat whitish; rest of underparts washed rufous and barred white; tail grey with 3-4 narrow white bars and white tip. Iris brownish yellow, legs yellow. Female drabber brown above; has reddish pink wash on belly and vent, with whitish barring, especially on thighs; tail more heavily barred; slightly larger than male. Immature lacks rufous "shoulder"; greyish brown above, buffy white below with

dusky and tawny streaking.

Habitat. Most common in virgin forests, including rain forest, subtropical dry and moist forest, pine forest and lower montane limestone karst forest. Tolerant of wide range of more disturbed agricultural and second growth habitats; also lowland scrub and montane pasture, from lowlands up to 2000 m.

Food and Feeding. Mostly vertebrates (more than similar *B. magnirostris*) and some insects; lizards (*Anolis*, *Leiocephalus*, *Ameiva*) and snakes (*Uromacer*) most numerous items at nest, but mammals (rats, mice, bats) more important by biomass; also takes birds, including Common Ground-dove (*Columbina passerina*) and Red-legged Thrush (*Turdus plumbeus*). Prey captured by perch-hunting; also by slow, gliding flight, reaching into cavities and vegetation to flush prey, and stooping from a soar.

Breeding. Nest building Feb-Apr. Nest of twigs, c. 50 cm wide, lined with moss, small roots; often in prominent tree, including palms, pines and hardwoods; male does most nest building; female trims nest with greenery, even 1 month after young fledge. Aerial display over nesting territory, with both birds soaring and male making shallow undulating stoops; copulation preceded by aerial display but not courtship feeding. 2 eggs; incubation at least 28-29 days; chicks have white down; fledging c. 12 weeks. Apparently no sibicide, as 2 young fed well into nesting period. Male provides 91% of food; only incubates when female is feeding. Territory averages c. 60 ha, with nests 300-1000 m apart; vigorously defended against conspecifics, crows and other raptors.

Movements. Resident.

Status and Conservation. INDETERMINATE. CITES II. Conflicting evidence; situation might be urgent. Locally common, yet rare over its entire range, which itself is limited to a few islands. Formerly widespread, but shooting and extensive deforestation must have taken substantial toll on population, despite tolerance of disturbed areas; continuing deforestation suggests species in decline; rate and extent of habitat destruction in Haiti leave little hope for future of species there. May persist in good numbers on some outlying islands, although most are now densely populated and heavily disturbed. Best populations now found in Los Haitises range, including a nominally, but poorly, protected national park.

Bibliography. Bond (1979), Collar & Andrew (1988), Collar *et al.* (1992), Davis (1972), Meyburg (1986), Stockton (1978), Wiley (1985, 1986), Wiley & Wiley (1981).

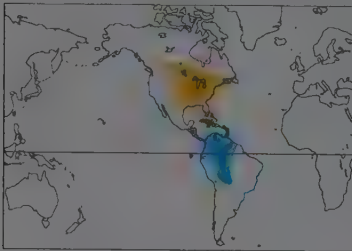
177. Broad-winged Hawk

Buteo platypterus

French: Petite Buse German: Breitflügelbussard Spanish: Busardo Aliancho
Other common names: Broadwing

Taxonomy. *Sparvius platypterus* Vieillot, 1823, near Schuylkill River, Pennsylvania. Six subspecies normally recognized.

Subspecies and Distribution.
B. p. platypterus (Vieillot, 1823) - C & S Canada to S USA; winters S to Brazil.
B. p. cubanensis Burns, 1911 - Cuba.
B. p. brunnescens Danforth & Smyth, 1935 - Puerto Rico.
B. p. insulicola Riley, 1908 - Antigua (Lesser Antilles).
B. p. rivierei A. H. Verrill, 1905 - Dominica, Martinique and St Lucia (Lesser Antilles).
B. p. antillarum Clark, 1905 - St Vincent and Grenada to Tobago.



Descriptive notes. 34-44 cm; 265-560 g; wingspan 86-100 cm, female slightly larger. Small, stoutish woodland *Buteo*; adult has brown upperparts and reddish barred underparts, reminiscent of *Accipiter cooperi*. Rare dark morph uniform blackish all over. Juvenile brownish, with streaked underparts, similar to juvenile *A. cooperi*. Races differ on pattern and intensity of underpart coloration.

Habitat. Inconspicuous bird of deep to semi-open deciduous and mixed woodlands. Frequent edges, openings and wet areas. Often nests near wet or mesic shaded areas with good canopy cover.

Food and Feeding. From spring to autumn, regularly takes over 30 species of small mammals, from size of mouse to small rabbit; birds of at least 25 species (to size of small grouse), and reptiles, amphibians and invertebrates (e.g. grasshoppers, dragonflies). More invertebrates apparently taken in austral non-breeding grounds, but food in non-breeding grounds poorly documented. Practices still-hunting from perch, concealed in tree, or more often at edge of opening or clearing, or even on exposed utility poles or from electric power lines; also direct searching in flight, generally at tree top level.

Breeding. Mar-Jul. Solitary. Carelessly built stick nest, usually in first main crotch of deciduous tree, or in conifer (sometimes in pine plantations); placed 6-14 m above ground; lined with greenery and bark chips. Sometimes uses nests of other raptors, crows (*Corvus*) or squirrels. Usually 2-3 eggs; incubation 28-31 days; chicks have white down and conspicuous black bill; nestlings may engage in siblicide; first leave nest 29-31 days, but fed by parents for c. 50 days. Can breed first at 1 year old, but normally at 2 years. Oldest ringed bird 14 years. Nest success: c. 83% of nests produced average of 1.8 young; average 1.5 fledged.

Movements. Highly migratory in North America, where entire population departs for winter, except birds in S Florida; sedentary in Caribbean. During boreal winter mainly occurs from Guatemala to S Peru and Brazil; some birds move 8800 km, mostly following overland route through C America. Migration patterns highly correlated with wind speed and direction. Autumn peak between mid-Sept and early Oct; spring peak mid-Mar in Panama, late Mar to early Apr in S Texas. During days of peak movement, daily flights may number 1000's, with up to estimated 100,000 seen in single day in E Mexico; along with *B. swainsoni* perhaps the most conspicuous North American raptor migrant, because of large concentrated flocks. Some migration concentration points in North America differ in spring and autumn.

Status and Conservation. Not globally threatened. CITES II. Common, with one estimate of over 1,000,000 individuals in North America. No evidence of decline in North American range during pesticide era. Caribbean populations may be under threat because of habitat alterations and loss of primary forests; *cubanensis* has also been reduced by shooting. In Puerto Rico, race *brunnescens* thought to number only 124 birds at three locations; currently proposed for listing as endangered.

Bibliography. Bednarz *et al.* (1990), Biaggi (1983), Blake (1977), Bond (1956), Burns (1911), Crocoll & Parker (1989), Fjeldså & Krabbe (1990), Friedmann (1950), Heintzelman (1975), Hilty & Brown (1986), Janik & Mosher (1982), Johnsgard (1990), Johnson & Peeters (1963), Keran (1978), Kerlinger (1989), King (1978/79), Lyons & Mosher (1982), Matray (1974), Meyer de Schauensee & Phelps (1978), Monroe (1968), Mosher & Matray (1974), Palmer (1988), Peck & James (1983), Pinto (1964), Ridgely & Gwynne (1989), Rosenfield (1978, 1984), Rosenfield *et al.* (1984), Rusch & Doerr (1972), Sick (1985a, 1993), Slud (1964), Smith, N.G. (1980), Snyder (1987), Snyder & Snyder (1991), Snyder & Wiley (1976), Stiles & Skutch (1989), Thibault & Guyot (1988), Thiollay (1980a), Titus & Mosher (1981), Wetmore (1965), Wiley (1986a, 1986b).

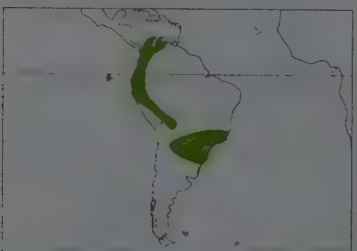
178. White-rumped Hawk

Buteo leucorrhous

French: Buse cul-blanc German: Weißbüßelbussard Spanish: Busardo Culiblanco
Other common names: Rufous-thighed Hawk

Taxonomy. *Falco leucorrhous* Quoy and Gaimard, 1824, Rio de Janeiro, Brazil. Monotypic.

Distribution. Apparently disjunct distribution: mountains of Venezuela and Colombia through Ecuador and Peru to NW Bolivia (Cochabamba, La Paz); Paraguay, S Brazil (N to Minas Gerais) and N Argentina (Salta, Tucumán, Chaco and Misiones).



Descriptive notes. 33-38 cm; male 290 g; wingspan 85 cm. Small *Buteo*; deep blackish overall, with conspicuous white rump and undertail-coverts and creamy white underwing-coverts; thighs rufous; tail, from above has single narrow greyish brown band in distal half, from below 2-3 white bands. Existence of pale morph, similar to that of *B. brachyurus*, has been claimed, but no clear evidence. Iris, cere, legs and feet yellow. Female similar to male, but slightly larger. Immature brown above, mottled with rufous; below heavily mottled rufous.

Habitat. Dense forest, forest edge and Chaco; in subtropical zone, prefers dense forest. Occurs at 1700-2900 m in Colombia, 1650-2500 m in Peru, and up to 3000 m in Bolivia; at lower elevations in Argentina (Misiones) and Paraguay.

Food and Feeding. Very little information available; known to take reptiles, frogs, insects and rats.

Breeding. 1 nest Feb-Mar in Colombia. 2-3 eggs (Argentina). No further information available.

Movements. Nothing known.

Status and Conservation. Not globally threatened. CITES II. Very little known, and status uncertain; generally rather local and nowhere common, but tolerates somewhat disturbed forest, so probably not threatened. In Argentina, seems to have decreased in response to deforestation; no recent records in NE Argentina. More data needed.

Bibliography. Belton (1984), Blake (1977), Contreras *et al.* (1990), Fjeldså & Krabbe (1990), Hilty & Brown (1986), Meyer de Schauensee & Phelps (1978), Navas & Bó (1991), Olog (1985), Parker & O'Neill (1980), Parker *et al.* (1980), de la Peña (1992), Pinto (1964), Remsen & Traylor (1989), Ruschi (1979), Sick (1985a, 1993).

179. Short-tailed Hawk

Buteo brachyurus

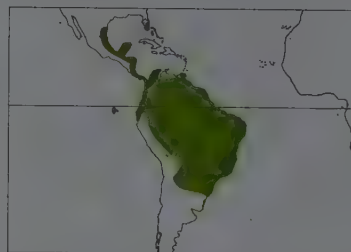
French: Buse à queue courte German: Kurzschnanzbussard Spanish: Busardo Colicorto

Taxonomy. *Buteo brachyurus* Vieillot, 1816, Cayenne.

Has been considered to include *B. albigula*, either as subspecies or within single monotypic species, but no intergradation reported, despite possible overlap of ranges; these two form superspecies. Two subspecies normally recognized.

Subspecies and Distribution.

B. b. fuliginosus P. L. Sclater, 1858 - S Florida (USA); E Mexico to Panama.
B. b. brachyurus Vieillot, 1816 - Colombia S to W Ecuador, E to the Guianas and Brazil, and S through E Peru and E Bolivia (La Paz and Cochabamba) to Paraguay and N Argentina (Jujuy, Tucumán, Misiones).



Descriptive notes. 37-46 cm; male 450-470 g, female 530 g; wingspan 90 cm. Polymorphic, with pale and dark morphs. Normal (pale) morph has upperparts and sides of head deep fuscous brown or slate black, narrow white forehead, and underparts nearly all white; tail greyish brown with several fuscous bands and whitish tip; differs from *B. albigula* in essentially pure white sides of breast and thighs. Rare dark morph has blackish body, white forehead, and wings and tail as normal morph. Iris brown, cere, legs and feet yellow. Female as male, but slightly larger. Immature streaked and spotted brown below, with more tail bands and some white feather edging above (normal morph). Race *fuliginosus*, in pale morph, browner with rufous brown on hindneck and sides of breast.

Habitat. Fairly catholic in requirements. Tropical lowlands through foothills into subtropical zone; occurs in humid tropical and deciduous forest, around interface between primary forest and pastures, and in open terrain, often near marshes. Generally at lower altitudes than *B. albigula*, mostly below 1800 m, but recorded up to 2500 m in Colombia.

Food and Feeding. Few data available, except from Florida (USA). Mainly birds: 96.3% of prey in one study in Florida, mostly Red-winged Blackbirds (*Agelaius phoeniceus*), but at least 23 other species; other birds recorded include *Falco sparverius* and *Accipiter striatus*; also rodents (3% in Florida), lizards and insects (wasps and grasshoppers). Said to soar 100-200 m up, then stoop at prey, taking birds off canopy of trees. Rarely seen perched.

Breeding. Poorly known. Laying Mar-May in Florida; nests Feb in Panama, Mar in Trinidad. Relatively large stick nest c. 70 cm wide built by both adults; lined with finer sticks and green leaves; placed 2-30 m high in tree. Courtship displays include high circling, sky-dancing and tumbling. Usually 2 eggs (1-3); incubation c. 34 days by female; chicks have whitish first down, grey second down.

Movements. Florida population shifts to S part of state in winter, but apparently does not cross much water, and not recorded from Cuba. Situation in Central America rather confusing, with coastal Mexican populations partly resident, but migratory flights reported in S Veracruz, and also in Honduras and Costa Rica, but not in Panama. No migration documented in rest of range, where presumably sedentary.

Status and Conservation. Not globally threatened. CITES II. Nowhere common, e.g. uncommon and thinly spread over Colombia; uncommon to rare in Florida (USA). Occurs over very large range, and is tolerant of disturbed habitat; situation apparently secure.

Bibliography. Amadon (1964), Andrie (1967), Belton (1984), Blake (1977), Brown, M. (1987), Cabot & Serrano (1986), Contreras *et al.* (1990), French (1973, 1992), Fjeldså & Krabbe (1990), Herklots (1961), Hilty & Brown (1986), Howell & Webb (1992a), Jaksic & Jiménez (1986), Johnsgard (1990), Lehman & Haffer (1960), Meyer de Schauensee & Phelps (1978), Mitchell & Millsap (1990), Monroe (1968), Ogden (1974), Olog (1985), Palmer (1988), de la Peña (1992), Pinto (1964), Rand (1960), Ridgely & Gwynne (1989), Robbins & Ridgely (1990), Slud (1964), Stiles & Skutch (1989), Stresemann (1959a), Thiollay (1980b, 1991a), Wetmore (1965), Willis (1988).

180. White-throated Hawk

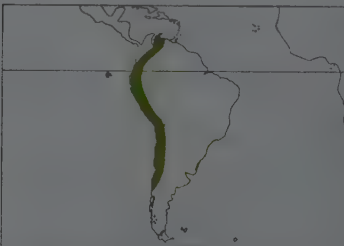
Buteo albigula

French: Buse à gorge blanche German: Weißkehlbussard Spanish: Busardo Gorgiblanco

Taxonomy. *Buteo albigula* Philippi, 1899, Valdivia, Chile.

Higher altitude representative of *B. brachyurus*, with which forms superspecies, and in which present species is sometimes included, but no hybridization reported, despite possible range overlap. Monotypic.

Distribution. Andes, from Venezuela and Colombia S to C Chile and WC Argentina.



Descriptive notes. 38-48 cm, wingspan c. 95 cm. Markings on sides of breast and thighs separate from *B. brachyurus*; tail noticeably longer. Brownish black above and on sides of head; white below, with sides of body chestnut, faintest and belly streaked brown, and thighs barred with rufous; tail dark brown above, greyish below, with 8-10 narrow dark bands. Dark morph unknown. Female as male, but somewhat larger. Immature has large blackish spots on breast and flanks.

Habitat. Generally from 1700 m to 3500 m in N half of range, but occasionally down to sea-level in Chile; humid mountain forest to

stunted forest and cloud forest at higher altitudes and adjacent open country, frequents areas with *Eucalyptus* in Ecuador, *Araucaria* in S of range.

Food and Feeding. Very few data available. Known to take rodents and birds.

Breeding. Season unknown. Nests on cliffs or in shrubs. No further information available.

Movements. Possibly migratory from southernmost parts of range; elsewhere presumably sedentary.
Status and Conservation. Not globally threatened. CITES II. Very poorly known. Generally rare and local throughout range, e.g. in Colombia. Preferred altitudinal range relatively less affected by human activities, especially transformation; also shows tolerance of disturbed habitat. Surveys and research required.

Bibliography. Blake (1977), Fjeldså & Krabbe (1990), Hilty & Brown (1986), Johnson (1965), Lehman & Haffer (1960), Meyer de Schauensee & Phelps (1978), de la Peña (1992), Stressemann, E. (1959).

181. Swainson's Hawk

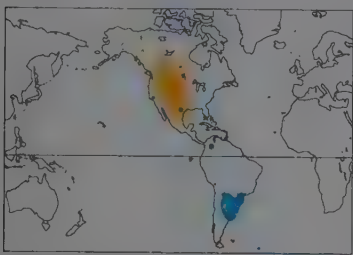
Buteo swainsoni

French: Buse de Swainson **German:** Präriebussard **Spanish:** Busardo Chapulinero

Taxonomy. *Buteo Swainsoni* Bonaparte, 1838, Fort Vancouver, Washington.

Monotypic.

Distribution. W & C North America from Alaska SE to Minnesota, and S to N Mexico. Winters mostly in South America, especially in N Argentina, S Brazil and Paraguay; also some birds in S & W USA.



Descriptive notes. 48-56 cm; male 683-936 g, female 937-1367 g; wingspan 124-137 cm. Extremely variable: adult pale morph has brown upperparts and bib, with white throat and belly; dark morph blackish overall; intermediate reddish morph similar to pale morph, but underparts with variable amounts of reddish barring; reddish morph grades into both of other morphs. Pale morph commonest. Juvenile has upperparts similar to adult, but with pale edgings; underparts streaked and blotched with yellowish brown.

Habitat. Most habitats, from woodland of aspen, oak and conifers to steppes and deserts;

most common in prairies and intermountain zone of W USA.

Food and Feeding. Seasonally variable diet: in breeding season, mainly mammals (rabbits, ground squirrels, voles and bats), but also birds, reptiles and some insects; in non-breeding season, mainly insects (grasshoppers, dragonflies, "locusts", beetles), some other invertebrates, occasional mammals (rodents) and birds. Perch-hunting is commonest technique; also hawks insects in flight. Often gregarious, especially in winter quarters, with sizeable flocks gathering where insects (e.g. grasshoppers) abundant; birds may snatch up prey while moving about rather clumsily on ground.

Breeding. Apr-Aug. Solitary, but often associated with *B. regalis*. Flimsy stick nest, typically in solitary tree, bush or small grove, sometimes on magpie (*Pica*) nest; often placed low down, close (2-3 m) to ground, with frequent use of shelterbelts planted by man; nest often lined with greenery. Usually 2-3 eggs (1-4); incubation 34-35 days; chicks have white down; fledging 42-44 days. Sexually mature at 2 years. Oldest ringed bird 16 years old. Nest success c. 65-75%; hatching success up to 93%; fledging success 60-75% of eggs laid; c. 1-7 young fledged per attempt.

Movements. Highly migratory. Main non-breeding grounds (boreal winter) in Argentina; migration follows a land route through C America, with some scattered wintering grounds in other open habitats of Neotropics. Some autumn migrant flocks in C America in 1000's; total of 400,000 recently recorded over Veracruz, E Mexico. May fly without feeding between S USA and winter quarters in South America. Increasingly some birds winter in Florida, California and also Texas.

Status and Conservation. Not globally threatened. CITES II. Total population conservatively estimated at 40,000-55,000 breeding pairs, but much higher numbers counted on migration through Mexico and Panama. Serious local declines, e.g. in California (90%) and Oregon; often attributed to pesticides, but local habitat problems more likely. Listed as possibly threatened (although with insufficient data) in USA in 1982, but removed from list in 1991.

Bibliography. Ambrosetti (1919), Bechard (1982, 1988), Bednarz (1988a), Blake (1977), Browning (1974), Clark & Wheeler (1987), Delius (1953), Dunkle (1977), Estep & Teresa (1992), Fitzner (1980), Fjeldså & Krabbe (1990), Gilmer & Stewart (1984), Henny & Kaiser (1979), Hilty & Brown (1986), Houston, C.S. (1974), Houston & Millar (1981), Houston *et al.* (1991), Janes (1985), Jaramillo (1993), Johnson (1960), Kirkley (1991), Littlefield *et al.* (1984), Olendorf (1973), Palmer (1988), Pinto (1964), Ridgely & Gwynne (1989), Risebrough *et al.* (1989), Rudolph & Fisher (1993), Schmutz (1984), Schmutz & Hungle (1989), Sick (1985a, 1993), Skutch (1945), Slud (1964), Smith, D.G. & Murphy (1973), Smith, N.G. (1980), Smith, N.G. *et al.* (1986), Snyder & Wiley (1976), Stendell & Gilmer (1988), Stiles & Skutch (1989), Thurow & White (1983), Thurow *et al.* (1980), Wetmore (1965), White *et al.* (1989), Woffinden (1986), Zotta (1931).

182. White-tailed Hawk

Buteo albicaudatus

French: Buse à queue blanche **German:** Weißschwanzbussard **Spanish:** Busardo Coliblanco

Taxonomy. *Buteo albicaudatus* Vieillot, 1816. South America = Rio de Janeiro.

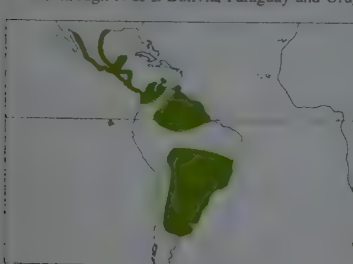
Closely allied to *B. galapagoensis*, with which forms superspecies, possibly also including *B. polyosoma*, which present species may replace at lower altitudes, and *B. poecliochrous*. Three subspecies recognized.

Subspecies and Distribution.

B. a. hypospodius Gurney, 1876 - SC USA (S Texas) and NW Mexico (Sonora) to N Colombia and NW Venezuela.

B. a. colonus Berlepsch, 1892 - E Colombia E to Surinam (except NW Venezuela), and S to Amazon, E from at least Manaus to Atlantic coast; Aruba, Curaçao, Bonaire and Trinidad.

B. a. albicaudatus Vieillot, 1816 - extreme SE Peru & S Brazil (S from Mato Grosso, Goiás and Bahia) through N & E Bolivia, Paraguay and Uruguay to N & C Argentina (S to Rio Negro).



Descriptive notes. 51-61 cm; 850-884 g. Polymorphic, with pale and dark morphs. Wings rather long for a *Buteo*; in pale morph, rufous shoulders, not upper back, separate from *B. poecliochrous* and smaller *B. polyosoma*. Pale morph has upper back, neck and head ashy grey; to blackish slate, shoulders prominently rufous; rump and tail white, black band near tip of tail; below nearly immaculate white, including underwing-coverts, but fine barring on sides and thighs. Dark morph greyish to dark slate below, belly finely barred white, and thighs often barred rufous and white; tail as in pale morph, usually some rufous on shoulders. Iris

hazel, cere pale green, feet yellow. Female marginally larger. Immature dark brown to black above; shoulders sometimes rufous, possibly in older individuals; rump buffy white barred rufous; underparts blackish (presumably immature dark morph) to dark brown with varying amounts of white; flanks and undertail white; tail pale grey to brown, with numerous narrow dark bands, becomes whiter with age. Race *hypospodius* slightly paler above, with white throat; *colonus* smaller and paler.

Habitat. Tropical to subtropical zones. Usually in semi-arid open country, but also found in dry, open woodland and moist palm savanna; exclusively shrub-steppe in N Argentinian Patagonia. Up to 1800 m in Colombia, to 2400 m in Bolivia.

Food and Feeding. Broad range of prey types and species, including snakes, lizards, cottontail rabbits (extensively when available), ground squirrels, rats, some birds (doves and young poultry), frogs, toads, crabs, cicadas, beetles, large earthworms (up to 1 m long in Brazil) and sometimes carrion. Regularly soars and hovers; perches on low shrubs or on ground. Recorded pirating food from *Elanus leucurus*. Frequently feeds at grass fires, commonly in groups of up to 20 birds, soaring and gliding through smoke, or perched near fire line.

Breeding. Most of data from N of range, in S USA. Laying Jan-Aug in S USA (late nests may be replacement clutches); most often dry season in Venezuela, but some rainy season records; nests in Jan-Aug in Colombia. Stick nest, up to 80 cm wide, lined with grass or sprays in palms, hardwoods or low shrubs if necessary; will reuse nests. Displays in air and on ground often associated with copulation; courtship, copulation and nest building take c. 1 month to complete. Usually 2 eggs (1-3); incubation averages 31-2 days (29-32), beginning with first egg; chicks have buff down, washed smoky brown; fledging c. 49-52 days.

Movements. Poorly known. Presumably sedentary over most of tropical range. Northernmost birds are not migratory, but populations further S in North America may be; purported migration may refer to irruptive movements in response to population declines of prey species.

Status and Conservation. Not globally threatened. CITES II. Extensive range; apparently on increase as result of deforestation. Relatively common in open areas in Brazil; expanding in E due to deforestation, and occurs near some large cities, e.g. Rio de Janeiro. Fairly common to locally common in Colombia. Declines reported in S Argentina in areas where strychnine used by sheep ranchers.

Bibliography. Belton (1984), Blake (1977), Contreras *et al.* (1990), Cottam & Knappen (1939), Donazar, Ceballos *et al.* (1993), Farquhar (1986, 1988, 1992, 1993), Fjeldså & Krabbe (1990), Graham *et al.* (1980), Haucke (1971), Heredia & Clark (1984), Hilty & Brown (1986), Howell (1971, 1972), Johnson (1990), Kopeny (1988a, 1988b), Mader (1981), Meyer de Schauensee & Phelps (1978), Monroe (1968), Morrison (1978), Olrog (1979), Palmer (1988), de la Peña (1992), Pinto (1964), Ridgely & Gwynne (1989), Ruschi (1979), Sherrod (1978), Sick (1985a, 1993), Slud (1964), Snyder & Wiley (1976), Stevenson & Meizen (1946), Stiles & Skutch (1989), Tewes (1984), Thiollay (1980b), Voous (1968, 1969), Wetmore (1965).

183. Galapagos Hawk

Buteo galapagoensis

French: Buse des Galapagos **German:** Galapagosbussard **Spanish:** Busardo de Galápagos

Taxonomy. *Polyborus galapagoensis* Gould, 1837, Galapagos Archipelago.

Closely related to *B. albicaudatus*, with which forms superspecies, perhaps also including *B. polyosoma* and *B. poecliochrous*. Monotypic.

Distribution. Galapagos Is.



Descriptive notes. 55 cm; wingspan c. 120 cm. Sooty brown overall; tail grey with narrow blackish bars. Iris brown, legs and cere yellow. Female similar, but appreciably larger. Immature blackish brown above, heavily mottled white and buff; below buff, heavily spotted blackish brown; tail buffy white, with numerous narrow blackish bars.

Habitat. All island habitats from shoreline to barren lava fields, open areas, closed deciduous forest and mountain peaks; nesting restricted to dry zones.

Food and Feeding. As the only diurnal raptor in Galapagos, it is not surprisingly a broad

generalist. Most important prey types are rodents (mostly indigenous *Oryzomys*, but also introduced *Rattus*), ground doves and lava lizards (*Tropidurus albamarensis*). Wide variety of other food sources also exploited: finches and mockingbirds (including plundered nests); young of seabirds from nesting colonies; young goats; iguanas (both marine and terrestrial, mostly taken by the more powerful females); hatchling tortoises and sea turtles; locusts; caterpillars; giant centipedes; carrion (seal placentas, goats, fish); and poultry. Prey habits idiosyncratic, as food delivered to adjacent nests (or even to same nest by different males) can be quite different. Usually hunts from the air at height of 50-200 m, mostly gliding but sometimes hovering.

Breeding. Recorded at various times of year; may not have well defined breeding season, instead being linked to weather patterns. Stick nest 80-100 cm wide, lined with grass, leaves, or bark, on prominent lava outflow, rocky outcrop or low tree: nest-site provides panorama of territory and used repeatedly, nest at times becoming quite large, up to 3 m deep. 1-3 eggs; incubation 37-38 days; fledging 50-60 days; incubation and fledging substantially longer than in comparable mainland *Buteo* species. Parents expel young within 3-4 months of fledging; juveniles spend at least 2-3 years away from territorial breeding areas before reaching sexual maturity at c. 3 years old. One of only c. 12 bird species with stable co-operative polyandrous mating system. 1-3 (up to 7) extra males participate in copulation, incubation, feeding of young and group defence of territory; groups appear stable, with birds remaining in territory in successive years; not all females have extra males. Usually only 1 young raised per group. Breeding success varies with climate; polyandrous groups produce more young than monogamous pairs, but pairs produce more young per male. Group-living males live longer than monogamous birds, so may have greater overall fitness, despite lower annual productivity; may also outlive other males to wind up in monogamous pair. On small Santa Fe I, a small population of juveniles (roughly even sex ratio) was present, with few non-breeding adults. On larger Santa Cruz I, with more varied terrain, a non-breeding population of well over 100 individuals was present, including a pool of 30-75 adult females; when these birds were added to breeding population, sex ratio almost even, suggesting that polyandry did not evolve as result of lack of potential mates for males. Ultimate cause for this system may be shortage of suitable breeding territories. On larger islands, where non-breeders stay in highlands, group size larger.

Movements. Sedentary.

Status and Conservation. RARE CITES II. According to early reports, was once very common, but subjected to severe persecution by settlers: as many as 250 nesting pairs on Santa Cruz in past now reduced to just a few pairs. Formerly on all large islands, and many of smaller islands, but range now greatly reduced and may now have been extirpated from five islands. Seems secure on Santiago and Santa Fe. Might be a species readily responsive to manipulative intervention, should populations reach dangerously low levels.

Bibliography. Butler (1979), Collar & Andrew (1988), Faaborg (1984, 1986), Faaborg *et al.* (1980), Harris (1982), King (1978/79), Meyburg (1986), Voous & de Vries (1978), de Vries (1973, 1975, 1976, 1984, 1989).



PLATE 18

inches 12
 cm 30

184. Red-backed Hawk

Buteo polyosoma

French: Buse tricolore German: Rotrückenbussard Spanish: Busardo Dorsirrojo
Other common names: Juan Fernandez Hawk (*exul*)

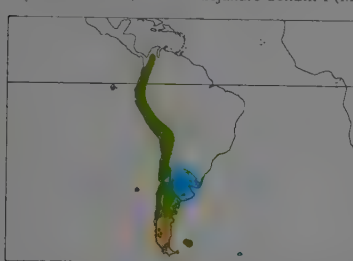
Taxonomy. *Falco polyosoma* Quoy and Gaimard, 1824, Falkland Islands.

Forms superspecies with *B. poecilochrous*, with which sometimes considered conspecific; much remains to be resolved about taxonomy of these species. May also be closely related to *B. galapagoensis* and *B. albicaudatus*, and all four sometimes included in superspecies; said to replace *B. albicaudatus* at medium altitude. Race *exul* may be approaching species status. Nominant race includes possible races *erythronotus*, *aethiops* and *peruviansis*. Two subspecies recognized.

Subspecies and Distribution.

B. p. polyosoma (Quoy & Gaimard, 1824) - C Andes of Colombia S through Andes to Patagonia and Tierra del Fuego; also Falkland Is.

B. p. exul Salvin, 1875 - Alejandro Selkirk I (Más Afuera) in Juan Fernández Is. off SC Chile.



Descriptive notes. 46-56 cm; 950 g; wingspan 110-120 cm. Whitish tail with black subterminal band. Highly variable, with tendency for sexes to differ in plumage: head, thighs and undertail dark brownish grey, back dark grey with upper back and most of underparts rufous; or similar, but with underparts white, finely barred on sides and belly; or entire body blackish to pale slate; or grey to slate above, white below; or brown to grey below with rufous band across breast, and rufous mantle. Rufous backed birds usually female, grey birds apparently males. Iris brownish (maybe yellowish), cere greenish yellow, legs and feet yellow.

Very similar to *B. poecilochrous*, which shows very similar range of plumage variation, but smaller, with longer, narrower wings and longer tail; 3rd primary (counting inwards towards body) longer than 5th. Female similar than male. Immature also variable: mostly brown with more or less white mottling; buff below streaked brown; sometimes has rufous in mantle; tail greyish with numerous dark bands. Race *exul* larger and darker, lacking rufous back of female.

Habitat. Tropical zone up to puna; 1800-3200 m, probably higher, in Colombia; up to 4600 m in Bolivia. Temperate zone forests in N of range, lower altitudes in Peru and S of range. Arid coastal lowlands of Ecuador; temperate and arid valleys; treeless shrub-steppe of Argentinian Patagonia; river valleys with gallery forest. Occupies broader altitudinal range (coastal lowlands and Chaco up to Altiplano) and more diverse habitats than *B. poecilochrous*; generally occurs at lower altitudes than latter species, although in Colombia confusingly seems to occupy higher elevations (1800-3200 m); in overlap zone in Bolivian Altiplano, present species tends to frequent flatter land, while *B. poecilochrous* prefers steeper, mountainous regions.

Food and Feeding. A generalist mammal predator, taking most prey roughly in proportion to its relative abundance. In Chile, 90% rodents, especially degu (*Octodon degus*); some (introduced) rabbits, mostly juveniles; also, to lesser extent, birds. In another study: 97% mammals; also lizards, Orthoptera and frogs. In Juan Fernández Is. feeds heavily on introduced mice (*Mus*), petrels and other birds, carrion (seals) and occasionally fish. Hunts actively, often hovering. Active all day, in contrast to *Geranoaetus melanoleucus*, with which it shares habitat. Prefers to fly and soar along, or perch on, north-facing slopes, where most updraughts seem to be, but also where vegetation sparsest.

Breeding. Nesting Dec-May in Ecuador; Sept-Oct in Chile; Nov-Dec in Argentina. Bulky stick nest lined with moss, lichens, leaves and trash; built on cliffs, in cacti, on shrubs or on telegraph poles. 1-3 eggs, with largest clutches in S of range; incubation apparently by both sexes; chicks have salmon pink down; fledging 40-50 days or more.

Movements. In Bolivia, birds in valleys may be permanent residents, while those in puna may be migrants from S. During austral winter, birds from Chilean Andes and Patagonia move N to subtropical lowlands of N & E Argentina, Paraguay and perhaps Uruguay. Formerly thought to be only a migrant to Colombia, but recently reported nesting there.

Status and Conservation. Not globally threatened. CITES II. Status poorly known, but in general appears to be relatively secure, and locally common, e.g. EC Ecuador. Apparently declining in Chile.

Bibliography. Blake (1977), Cabot (1991), Cabot & Serrano (1986, 1988), Contreras *et al.* (1990), Donazar, Ceballos *et al.* (1993), Fjeldså & Krabbe (1990), Fuentes *et al.* (1993), Hilty & Brown (1986), Humphrey, Bridge *et al.* (1970), Humphrey, Péfaur & Rasmussen (1993), Jaksic & Delibes (1987), Jaksic & Jiménez (1986), Jaksic, Greene & Yáñez (1981), Jaksic, Jiménez *et al.* (1992), Jiménez & Jaksic (1991), Johnson (1965), Koepeke (1970), Marchant (1960), de la Peña (1992), Schlatter, Yáñez & Jaksic (1980), Thillay (1991a), Vaurie (1962), Woods (1988).

185. Puna Hawk

Buteo poecilochrous

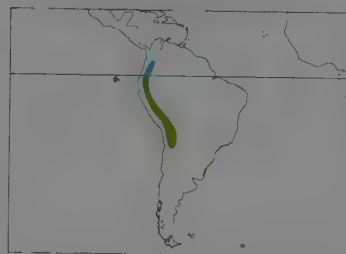
French: Buse du puna German: Punabussard Spanish: Busardo Puneño
Other common names: Gurney's Buzzard, Variable Hawk

Taxonomy. *Buteo poecilochrous* Gurney, 1879, Yanayacu, Ecuador.

Forms superspecies with *B. polyosoma*, of which sometimes considered a race; taxonomy of these species uncertain. May also be related to *B. galapagoensis* and *B. albicaudatus*, and all four sometimes included in superspecies. Monotypic.

Distribution. Andes from S Colombia (C Andes and Cauca) S to N Chile and NW Argentina.

Descriptive notes. 51-61 cm; c. 1000 g; wingspan 125-150 cm. Whitish tail with black subterminal band. Plumage highly variable: dark morph, all dark slate grey except tail, apparently commonest form; females frequently have chestnut mantle, and sometimes breast. Cere, legs and feet yellow. Larger than *B. polyosoma*, with broader wings and shorter tail; 3rd primary (counting inwards towards body) shorter than 5th; plumage variation virtually identical, but lacks colour morph with brownish grey throat, thighs and undertail, and rufous breast and belly. Female similar to male, but larger. Immature also variable: some birds all dark; others mostly whitish below, with some brownish mottling; many intermediate forms.



Habitat. Puna and páramo zones, mostly above 3000 m, and ranging up to 5000 m in Bolivia. Tends to frequent open areas, including deserts and semi-deserts, in Altiplano, and steep rocky areas in higher mountains. Also high altitude Polylepis woodlands. Peruvian puna and surrounding mountains. More specialized in habitat than *B. polyosoma*, normally occurring at higher altitudes; in Colombia, situation may be reversed, with present species occupying lower elevations (900-2000 m) than *B. polyosoma* (1800-3000 m).

Food and Feeding. Small mammals, insects and birds; wide variety of other items, including earthworms, toads and fish (trout). Both during and outside breeding season, small rodents, especially caviés (Caviidae), make up 15-20% of prey items recorded, and the substantial proportion of biomass consumed; in Ecuador, especially forest rabbit (*Sylvilagus brasiliensis*) and *Thomasomys* mice. Over half of recorded prey items were insects (mostly Tenebrionidae and Curculionidae) at two study sites, but these represent small percentage of biomass. Birds constitute up to 7% of prey items on breeding ground. Often searches for prey by hanging in updraught, low over ground, or quite high up; often soars high over mountains.

Breeding. In puna, breeds in warm and rainy season; eggs in most months in Ecuador. Monogamous, but also co-operative and perhaps polyandrous; in 2 different groups, 3 males simultaneously shared duties with 1 female, over 3 seasons. Stick nest c. 20 m up on cliff, typically on ledge or in cave. Clutch of 2+ eggs; incubation 36 days, by female and male(s); chicks have cream-coloured down; fledging 74 days. In study in Ecuador, of 6 breeding attempts by monogamous pairs, 3 failed at egg stage; of 6 attempts by co-operative groups, all successful.

Movements. Some local movements recorded, e.g. in N Chile breeds on high Andean plateau at 4500 m, and moves down to 3000 m outside breeding season. Somewhat confusing situation in Colombia, where species suspected to be migrant, because no breeding reported, but populations in Bolivia and Peru reported to be resident all year round, leaving source of any migrants to Colombia as a mystery.

Status and Conservation. Not globally threatened. CITES II. Generally common; particularly common in region of Mt Antisana (NC Ecuador), where several breeding groups have been object of detailed research in recent years; rare in Chile. Relatively extensive range in habitat that is not subject to excessive human encroachment suggests species secure at present.

Bibliography. Amadon (1964), Balke (1977), Cabot (1991), Cabot & Serrano (1986, 1988), Coello (1993), Contreras *et al.* (1990), Fjeldså & Krabbe (1990), Hilty & Brown (1986), Jaksic & Jiménez (1986), Jaksic *et al.* (1991), Jiménez & Jaksic (1990a), Johnson (1965, 1967), Koepeke (1970), Macedo (1964), Meyburg (1986), de la Peña (1992), Vaurie (1962).

186. Zone-tailed Hawk

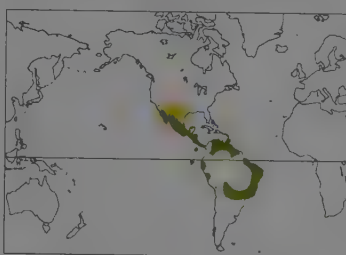
Buteo albonotatus

French: Buse à queue barrée German: Mohrenbussard Spanish: Busardo Aura

Taxonomy. *Buteo albonotatus* Kaup (ex G. R. Gray), 1847, Mexico.

Populations from E Panama and South America sometimes awarded separate race, *abbreviatus*, but not generally accepted. Monotypic.

Distribution. Range disjunct or incompletely known: NW & NC Mexico (from Baja California) and adjacent USA. S through Yucatán (not recorded in Belize) and Guatemala (including W highlands) to Panama, including Pearl Is. In South America, distribution incompletely encircles Amazon Basin: W Ecuador; C Peru, near Lima; N Colombia (Sta Marta Mts to Magdalena) E through N & SE Venezuela to the Guianas and Trinidad; N, E & SE Brazil (from Amazon Delta and I de Marajó, S and E through Ceará, Pernambuco, Alagoas and Bahia to Paraná) W through Paraguay to N & E Bolivia (Beni, Santa Cruz).



Descriptive notes. 45-56 cm; male 607-667 g, female 845-937 g; wingspan 121-140 cm. Uniform black or brownish black; relatively long blackish tail narrowly tipped white, with three bands, greyish above, whitish below; from below, greyish flight-feathers contrast with blackish underwing and body. Birds from South America average somewhat smaller. In flight recalls larger Turkey Vulture (*Cathartes aura*), especially from below. Iris reddish brown or dark brown, cere and legs yellow. Female similar to male, but larger. Immature browner, with white spotting on underparts.

Habitat. A habitat generalist, in tropical to

subtropical lowlands: savannas or scrub, *caatinga*, dry deciduous forest, humid forest, coniferous and mixed pine and oak forest, riparian woodland and ranchland; up to 500 m in Colombia.

Food and Feeding. Prey includes small mammals, birds (both adults and nestlings) and lizards. In Durango, NC Mexico: 38% of prey items were birds, roughly half of which were Red-shafted Flickers (*Colaptes cafer*) and rest unidentified; 43% mammals, predominantly cotton rats (*Sigmodon*); and 19% reptiles. Lizards particularly important in S USA. Also said to take frogs and fish, but these records may be due to confusion with *Buteogallus anthracinus*. Typical hunting behaviour very active: involves slowly soaring c. 15-30 m up and suddenly diving on prey, either on the ground or in tree canopy. In underwing coloration and flight pattern, remarkably similar to Turkey Vulture (*Cathartes aura*), which it may mimic; soars with wings flat as in most *Buteo* species, then raises them in dihedral, in style similar to *C. aura*; function may be to appear innocuous to potential prey, which consequently does not seek cover in time to avoid capture. Further support for suggested mimicry in resemblance to *C. aura* in both adult and immature plumages. Often soars in company with *C. aura*, and ranges overlap extensively, with present species invariably less common.

Breeding. Laying in late Apr. USA: Feb-Mar, Trinidad; incubation in Aug. Colombia: small chick in May, Venezuela; fledging mid-Jul. Mexico. Bulky stick nest trimmed with green leaves; placed 7-30 m high in trees, or on cliffs; in Texas (USA), most nests in tall trees in steep-sided canyons.

Usually 2 eggs (1-3); incubation c. 35 days; chicks have greyish down; fledging c. 6-7 weeks. One adult does most of the feeding, while the other defends the brood. In Mexico, young left nesting area c. 1 month after fledging.

Movements. Northernmost birds mostly migratory but some individuals overwinter at N limit of range. In Panama, most birds migrants, but reports throughout year suggest a resident breeding population may have developed. Birds in South America have been claimed to be migrants from N, but species regularly breeds in Venezuela, and perhaps on Trinidad; status of birds further S requires confirmation.

Status and Conservation. Not globally threatened. CITES II. Rather patchy distribution, but widespread and locally common. Relatively common in NE Brazil; apparently local in Colombia. Tendency to use wide variety of habitats, together with extensive range, suggests species secure at present.

Bibliography. Blake (1977), French (1973, 1992), Friedmann & Smith (1950, 1955), Hilty & Brown (1986), Hiraldo *et al.* (1989), Johnsgard (1990), Matteson & Riley (1981), Meyer de Schauensee & Phelps (1978), Millsap (1981b), Monroe (1968), Mueller (1972), Orias & Paulson (1969), Ornat *et al.* (1989), Palmer (1988), Pinto (1964), Ridgely & Gwynne (1989), Sherrod (1978), Sick (1985a, 1993), Slud (1964), Stiles & Skutch (1989), Teixeira *et al.* (1987a), Vannini (1989), Wetmore (1965), Willis (1963, 1966), Wilson *et al.* (1993), Zimmerman (1976a).

187. Hawaiian Hawk

Buteo solitarius

French: Buse d'Hawaï **German:** Hawaiiibussard **Spanish:** Busardo Hawaiano
Other common names: 'Io

Taxonomy. *Buteo solitarius* Peale, 1848, Kealakekua Bay, Hawaii.

Mistakenly identified as *Onychotes gruberi*, a new species from California by Ridgway in 1885. Monotypic.

Distribution. Endemic to Hawaiian Is; known to breed only on Hawaii I, but vagrants seen on at least three other islands of archipelago.



Descriptive notes. 41-46 cm; 385-650 g, male averages 441 g, female 606 g. Medium-sized buzzard, with most pronounced sexual size dimorphism in *Buteo*. Distinct pale and dark morphs and intermediate plumages. Pale morph adult has pale underparts, more or less streaked with brown on breast; immature unmarked golden buff on head and breast. Dark morph adult uniform dark brown; immature has tawny mottling on head and breast.

Habitat. Broad range of habitats up to 2700 m, from lowland agricultural areas to all types of forest, including exotic lowland forests near sea-level; virtually absent from arid regions

with little woody vegetation.

Food and Feeding. Varied diet, including mammals, birds and insects; sometimes large numbers of introduced spider *Agriopae avara*. Avian prey taken more frequently (60-68%) by birds at low altitude nests located in forested and agricultural areas; mammals are most common prey taken by pairs at medium altitude nests in pastureland. Usually seen soaring over forest or agricultural lands, but spends much time perched below forest canopy; juveniles frequently observed catching cockroaches.

Breeding. Mar-Aug. Bulky nest 50-78 cm wide, 13-50 cm deep, lined with green leaves; built 3.5-18 m above ground in small or large tree, often on top of bird's nest ferns (*Asplenium nidus*), on trunk crotches or on large or medium-sized branches. Clutch size reported as 2-3 eggs, but no indication of more than 1 egg laid in 30 nesting attempts recorded; incubation 38 days; chicks have dingy white to grey down; fledging 59-63 days; much extended post-fledging dependency, of up to 30+ weeks. Age of sexual maturity unknown; most pairs do not breed annually, although territories are maintained. Hatching success c. 88%; fledging success 62-73% of eggs laid.

Movements. Breeding adults generally sedentary; males typically remain within a discrete home range (48-562 ha) throughout the year, whereas female home range size larger (459-642 ha); females appear to roam widely within home range during non-breeding season, and some leave normal home range for extended periods during autumn and early winter.

Status and Conservation. RARE. CITES II. Currently listed as endangered by government of USA, but recently (1993) proposed for down-listing to threatened. Total population thought to be fairly stable and roughly estimated at 2700 birds, but figure principally from extrapolations of home range sizes of radio-tagged birds. Lack of accurate information on historical and current numbers makes assessment of population trends impossible. While species is well adapted to introduced flora and fauna of the islands, extensive clearing of forests for agriculture has undoubtedly decreased nesting habitat. In past, species protected by local beliefs; subsequently suffered extensively from shooting, but apparently infrequent now; repeated disturbance of nests can also be severe problem, causing nesting failure.

Bibliography. Anon (1984), Banko (1980), Berger (1981), Collar & Andrew (1988), Ehrlich *et al.* (1992), Ferguson-Lees & Faull (1992), Griffin (1985, 1989), King (1978/79), Munro (1960), Olson & James (1991), Peale (1848), Pratt *et al.* (1987), Ridgway (1885), Scott *et al.* (1986).

188. Red-tailed Hawk

Buteo jamaicensis

French: Buse à queue rousse **German:** Rotschwanzbussard **Spanish:** Busardo Colirrojo
Other common names: Harlan's Hawk (*harlani*)

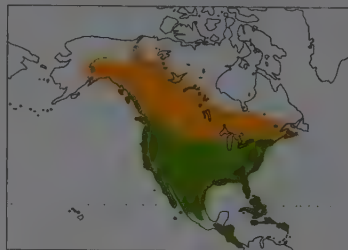
Taxonomy. *Falco jamaicensis* Gmelin, 1788, Jamaica.

Forms superspecies with *B. ventralis*. Some authors include *B. buteo*, *B. oreophilus* and *B. brachypterus* in same superspecies. Race *harlani* has variously been treated as full species, or colour morph of *calurus*. Likewise, *keideri* sometimes considered a morph, mainly within range of *calurus*, but also in boundary region between *calurus* and *borealis*; however, *kriderii* is a pale form inhabiting an area also occupied by similarly pale race *richardsoni* of Merlin (*Falco columbarius*). Fourteen subspecies normally recognized.

Subspecies and Distribution.

B. j. atacensis Grinnell, 1909 - SE Alaska (USA) and coastal British Columbia (W Canada).
B. j. harlani (Audubon, 1830) - interior of Alaska, SW Yukon and N British Columbia.
B. j. calurus Cassin, 1856 - W North America W of Great Plains.
B. j. borealis (Gmelin, 1788) - N America E of Great Plains of C USA and Canada.

B. j. kriderii Hoopes, 1873 - plains of SC Canada S to Wyoming (NC USA).
B. j. fuertesi Sutton & Van Tyne, 1935 - Texas (S USA) to N Mexico.
B. j. hadropus Storer, 1962 - highlands of C Mexico.
B. j. kemsiesi Oberholser, 1959 - Chiapas (S Mexico) to N Nicaragua.
B. j. costaricensis Ridgway, 1874 - Costa Rica.
B. j. fumosus Nelson, 1898 - Tres Marias Is, off WC Mexico.
B. j. socorroensis Nelson, 1898 - Socorro I (Revillagigedo Is), off W Mexico.
B. j. umbrinus Bangs, 1901 - Florida (SE USA).
B. j. solitudinis Barbour, 1935 - Bahamas and Cuba.
B. j. jamaicensis (Gmelin, 1788) - Jamaica, Puerto Rico and Hispaniola E to N Lesser Antilles.



Descriptive notes. Male 45-56 cm, 690-1300 g; larger female 50-65 cm, 900-1460 g; wingspan c. 105-135 cm. Typical large, stoutish soaring buzzard. Very variable; upperparts usually dark brown, underparts from buffy-whitish to red or black, sometimes mottled; tail ranges from reddish chestnut to marbled with red, brown, grey and white. Juvenile has pale to dark brown upperparts; underpart colours variable in same fashion as adult, with vertical streaking usually visible, except in extreme melanistic individuals; tail barred, similar in colour to upperparts. Races separated by size and coloration. Presence and percentage

of colour morphs varies regionally, sometimes by race: in Alaska, mainly melanistic (*harlani*); in W North America, highly variable, but characteristically with rufous underparts (*calurus*, *socorroensis*); in E North America and Cuba predominantly or totally pale morph (*borealis*, *solitudinis*). **Habitat.** Ubiquitous; most habitats from desert, agricultural land, forest and woodland to tropical rain forest and even urban areas. Usually requires some elevated perches, e.g. trees or bluffs, in areas of open plains and grasslands.

Food and Feeding. Mainly small to medium-sized mammals, birds and reptiles. Major mammalian food in North America includes voles (*Microtus*), mice (*Peromyscus*), squirrels (*Spermophilus*) gophers (*Thomomys*) and lagomorphs (*Sylvilagus*, *Lepus*); frequently caught birds are Ring-necked Pheasant (*Phasianus*), quails (*Colinus*, *Callipepla*) and passerines around size of Starling (*Sturnus*). Locally, snakes may constitute 50% of biomass. In Caribbean, diet varies with habitat: 88% mammals in dry lowlands; 49% herps in cloud forest. Lizards, birds and crabs are main natural foods of *socorroensis*, since no native mammals occur in range. Prey size varies normally from 15 g to 2000 g (not accounting for arthropods and small amphibians). Most hunting (60%-80%) from elevated perch, but may use soaring, and 80% of attacks in rain or cloud forest from flight; also uses flap-and-glide flight only 10-50 m above ground.

Breeding. Late Apr-Jul in Alaska, Dec-May in S USA, Nov-May in Caribbean. Solitary. Stick nest placed in trees, cliffs or saguaro cactus, or on artificial structures (towers, electric power poles), or even buildings in urban areas. Nest large (71-76 cm) and may be refurbished during several years; usually lined with greenery or bark. Clutch size averages 2.9 in N Canada and NW USA; 2.1 in Florida; 2.3 in Caribbean; and 1.9 in low food years in Alaska, where main prey is cyclical; incubation 28-35 days; nestlings have white to greyish brown down, with white occipital spot; fledging 42-48 days; chicks stay with parents for additional 30-70 days. Co-operative breeding recorded, with 2 females and 1 male. May breed first at 2 years. Oldest ringed bird 21.5 years. Nest success c. 73-83% but as low as 60% in rain forests; c. 0.7-1.8 young fledged per attempt, with minimum in rain forest.

Movements. Variable: sedentary from S USA to S edge of range in C America and Caribbean; migratory in N of range, but resident over most of USA. From W boreal areas may move as far S as Panama to winter. Autumn migration starts in Aug and ends in Dec, peak (involving 75% of birds) in New Jersey between late Oct and late Nov. In W North America, migrates over broad front, but may follow leading lines, e.g. rivers, mountain ranges. Spring migration may start Feb, and birds may arrive in far N as late as Jun.

Status and Conservation. Not globally threatened. CITES II. Commonest *Buteo* over most of North America; locally increasing and expanding range, at expense of *B. lineatus* and perhaps *B. swainsoni*, in areas where habitats are modified. Between 1970's and 1980's, numbers in winter estimated to have increased by 33% in S Canada and USA to 350,000 birds. No comprehensive estimates for S part of range.

Bibliography. Austing (1964), Bechard *et al.* (1985), Bildstein (1978), Blake (1977), Bohm (1978), Brinker & Erdman (1985), Clark & Wheeler (1987), Comner (1974), Comman (1973), Cotrell (1981), Diesel (1983), Fitch *et al.* (1946), Gates (1972), Hardy (1939), Henny & Wight (1972), Hoffman, S.W. *et al.* (1992), Houston & Bechard (1983), James (1984, 1985), Jehl & Parkes (1982), Johnsgard (1990), Johnson (1973, 1986), Knight & Erickson (1976), Lowe (1978), Lutich *et al.* (1971), Mader (1978), Mindell (1983), Moritsch (1983), Palmer (1988), Peterson & Thompson (1977), Preston (1990), Preston & Beane (1993), Ridgely & Gwynne (1989), Rothfels & Lein (1983), Santana & Temple (1988), Santana *et al.* (1986), Slud (1964), Snyder (1987), Snyder & Snyder (1991), Snyder & Wiley (1976), Stiles & Skutch (1989), Taverner (1927), Titus & Fuller (1990), Wetmore (1965), Wiley (1975b).

189. Rufous-tailed Hawk

Buteo ventralis

French: Buse de Patagonie **German:** Magellanbussard **Spanish:** Busardo Patagón
Other common names: Red-tailed Buzzard(!)

Taxonomy. *Buteo ventralis* Gould, 1837, no locality = Santa Cruz, Patagonia.

Long considered colour morph of *B. polyosoma*; alternatively race of *B. jamaicensis*, with which forms superspecies, some authors also including *B. buteo*, *B. oreophilus*, and *B. brachypterus*. Includes synonymous *B. pictus*. Monotypic.

Distribution. From SC Chile (Ñuble) and SC Argentina (Río Negro) S through Patagonia to Straits of Magellan.

Descriptive notes. 54-60 cm; 950 g; wingspan 130 cm. Polymorphic, with pale and dark morphs. Pale rufous morph has upperparts dark brown to blackish; throat white, rest of underparts russet to rusty with black streaks and hatching, and russet thighs; tail rufous with 8-10 black bars, the last broadest, and white tip. Dark morph sooty black, paler below, with undersides of wings and tail mottled grey. Iris dark reddish brown, legs and feet yellow. Female similar to male, but larger. Immature is fuscous brown above, with feathers edged rufous and whitish; below white, with sides of breast and belly streaked black; tail lacks rufous; indistinguishable from juvenile *B. jamaicensis*.

Habitat. Seems to be poorly understood, or species is generalist; reported from (dense) forest, open parkland and tree-lined fields, open coastal grassland, stunted *Nothofagus* forest and ridges and plateaux of Patagonian brush-steppe. From sea-level up to 1200 m.



Food and Feeding. Very few data available. Rabbits and one Southern Lapwing (*Vanellus chilensis*) recorded, but probably also takes smaller prey, e.g. small rodents. A powerful species; mostly hunts from perch; sometimes soars, and also seen hovering.

Breeding. Laying probably in Oct-Nov. Only two nests reported, both over 33 m high, one in Chilean oak, one in laurel (*Lurelia aromatica*); built of sticks, lined with feathers and wool. 3 young collected from 1 nest.

Movements. Appears to be resident.

Status and Conservation. Not globally threatened. CITES II. Until recently red-listed

in category Insufficiently Known, but currently considered near-threatened. Apparently rare throughout range; status remains poorly known, but species does not appear to be in immediate danger. Lack of sightings in one area that had been logged might suggest that species requires fairly undisturbed areas, but elsewhere recorded in more humanized habitats. Holocene material indicates former presence on Tierra del Fuego, where species not otherwise recorded.

Bibliography. Amadon (1964), Blake (1977), Clark, W.S. (1986), Collar & Andrew (1988), Daciuk (1977), Fjeldså & Krabbe (1990), Goodall *et al.* (1957), Greer & Bullock (1966), Humphrey, Bridge *et al.* (1970), Humphrey, Péfaur & Rasmussen (1993), Jaksic & Jiménez (1986), Johnson (1965), Meyburg (1986), de la Peña (1992), Rasmussen *et al.* (1992), Rasmussen & López (1988), Venegas & Jory (1979), Vuilleumier (1985).

190. Eurasian Buzzard

Buteo buteo

French: Buse variable

German: Mäusebussard

Spanish: Busardo Ratónero

Other common names: Common Buzzard

Taxonomy. *Falco Buteo* Linnaeus, 1758, Sweden.

Sometimes considered conspecific with *B. oreophilus* and also *B. brachypterus*; forms superspecies with these two, and possibly also with *B. jamaicensis* and *B. ventralis*; *B. jamaicensis* has been included in present species. Races *vulpinus*, *menetriesi* and *japonicus* all approaching species threshold. Island races poorly defined and possibly better rejected; birds from Madeira have also been awarded dubious race, *harterti*; birds from Italy and Sicily sometimes lumped in same race as those of Corsica and Sardinia, with priority for name *pojana*. Eleven subspecies normally recognized.

Subspecies and Distribution.

B. b. buteo (Linnaeus, 1758) - Europe E to Finland, Romania and Turkey; also Madeira; winters in S of range, and irregularly S to Liberia.

B. b. arrigonii Picchi, 1903 - Corsica and Sardinia.

B. b. rothschildi Swann, 1919 - Azores.

B. b. insularum Floericke, 1903 - Canary Is.

B. b. bannermani Swann, 1919 - Cape Verde Is.

B. b. vulpinus Gloger, 1833 - N Scandinavia and European Russia E to R Yenisey, and S to N Caucasus and C Asia (Altai, Tien Shan); winters mainly in Africa S of Sahara, and also in S Asia.

B. b. menetriesi Bogdanov, 1879 - S Crimea and Caucasus S to E Turkey and N Iran.

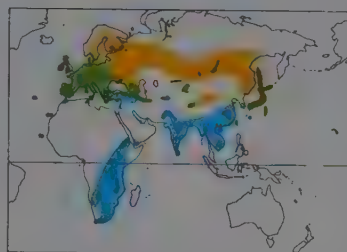
B. b. japonicus Temminck & Schlegel, 1844 - L. Baikal area and Mongolia E through Amurland and Manchuria to Sakhalin, Japan and Kuril Is, and S to Tibet, and possibly NW India; winters in S Asia, from India to Japan.

B. b. refectus Portenko, 1929 - W China and perhaps Himalayas.

B. b. toyoshimai Momiyama, 1927 - Izu Is and Bonin Is.

B. b. oshiroi Nagahisa Kuroda, 1971 - Daito Is (to E of C Ryukyu Is).

Descriptive notes. 50-57 cm; male 525-1183 g, female 625-1364 g; wingspan 113-128 cm. Extremely variable. Generally dark brown above and on most of underbody and underwing-coverts; from below, wingtip and trailing edge of wing dark, flight-feathers barred, pale area in outer primaries. Juvenile lacks broad band at tip of tail; dark band along trailing edge of wing less noticeable; generally paler and streaked on underparts. Extensive geographical variation, partly clinal and confounded by individual variation; races separated on size, coloration and plumage pattern; race *vulpinus* normally smaller, often with rusty underbody, underwing-coverts and upperside of tail, generally separable from *B. rufinus* on darker head and faintly barred tail; race *menetriesi* rather similar to *vulpinus*, but larger.



Habitat. Very variable, but almost always with some degree of tree cover, as species needs trees for nesting and roosting in. Prefers edges of woods and areas where cultivation, meadows, pastures or moors alternate with coniferous or deciduous woods, or at least clumps of trees. In winter, ranges into areas with very few trees, e.g. open fields, steppe or wetlands. Mainly flat terrain or gentle slopes at low or moderate altitudes; also in mountains, where in summer may forage above tree-line. Regularly perches on trees, poles, posts, rocks and pylons.

Food and Feeding. Adaptable, basing diet on

different prey types, according to local and seasonal availability. Essentially a hunter of small mammals, which often constitute up to 90% or more of prey; particularly rodents, with voles main prey over much of range; also mice, rats, hamsters, shrews, moles, young rabbits and hares; where abundant, rabbits can be locally important. Sometimes dominant prey by number are invertebrates, e.g. beetles, crickets, locusts and earthworms; reptiles locally important, including lizards, slow-worms and snakes; few amphibians; birds can be important by mass, particularly when mammals scarce, and occasionally species up to size of pigeon, pheasant and partridge taken. Occasionally scavenges carrion, e.g. medium-sized mammals, such as sheep. Hunts in clearings and open areas near edges of woods; almost always captures prey on ground. Spends long periods perched, scanning or loafing; also spots prey from gliding or soaring flight; sometimes hovers or hangs on wind; also walks on ground, when hunting invertebrates.

Breeding. Laying from late Mar to May, varying with latitude. Normally nests in large tree, fairly close to edge of wood; occasionally (normally in some regions) on cliffs. Nest is bulky platform of sticks and twigs, lined with greenery; built in fork or on branch near trunk; nests of other raptors sometimes used; each pair normally has several nests, switching to a different one each year. Normally 2-4 eggs (1-5); incubation 33-38 days per egg, mainly by female; male brings food at first, but female too once chicks 3 weeks old; chicks have first and second down white or brownish grey; fledging 50-60 days; independence 6-8 weeks later. Up to 3 chicks fledge (average 1.0-2.4 per successful pair, in Germany). Sexual maturity normally at 3 years, unusually at 1 year old. Oldest recorded bird over 25 years old.

Movements. Migratory in Scandinavia (wintering in S Sweden), and in most of former USSR; partially migratory in C Europe (increasingly so with latitude); sedentary in Britain, S Europe, Turkey, Caucasus, Japan and in island populations. Winters in Africa, Israel and Arabia; easternmost breeding populations winter in India, Indochina and China; part of C European population move S and SW in autumn, with some migrants reaching NW or even W Africa. Race *vulpinus* completely migratory, travelling up to 13,000 km, to winter in S Europe and SW Asia, but mainly in sub-Saharan Africa, particularly in S; crosses over to Africa mainly via Bab al Mandab in autumn, and returns by Suez in spring; 465,827 birds recorded at Elat (Israel) in spring 1986. Race *menetriesi* apparently non-migratory. Length of migrants' absence from breeding grounds increases with latitude.

Status and Conservation. Not globally threatened, CITES II. Probably second (or third) commonest raptor species in Europe; greatest abundance in e.g. Poland and former USSR; rough estimates of 160,000-300,000 pairs in Europe (excluding former USSR), 400,000 pairs in European Russia, and 8000-11,000 pairs in Byelorussia; race *japonicus* numerous and stable at present in Asian Russia. Race *insularum* of Canary Is probably numbers over 400 pairs (1990). Decline during much of 20th century in Europe, but stabilization with local increases mainly from 1970's. Range much reduced in Britain by early 20th century; subsequent increase and expansion back towards E, but process slowed up in 1950's, when myxomatosis epidemic killed off c. 99% of rabbit population; 12,000-15,000 pairs in 1983. Most important cause of decline has been direct persecution; also affected by use of poisoned baits and pesticides, by habitat loss and increasing rarity of prey.

Bibliography. Ali & Ripley (1978), Beklova & Pikula (1988), Benson & Benson (1975), Brazil (1991), Brazil & Hanawa (1991), Broekhuysen & Siegfried (1970), Brown *et al.* (1982), Cramp & Simmons (1980), Dare (1961), Dementiev & Gladkov (1951), Etchécopar & Hue (1978), Flint *et al.* (1984), Froehlich & Kneitz (1990), Gensbol (1986), Ginn *et al.* (1989), Goodman *et al.* (1989), Halley (1993), Handrinos & Demetropoulos (1983), Holstein (1956), Hou *et al.* (1990), Hubert (1993), James (1988), Kjellen (1992), Kostrewa (1986), Kostrewa & Kostrewa (1994), Mackworth-Præd & Grant (1962), van Marle & Voous (1988), Mebs (1964), Møller (1977), Moore (1957), Newton, Davis & Davis (1982), Patrikeev (1993), Paz (1987), Picozzi & Weir (1976), Rasmussen & Storgård (1989), Roberts (1991), Rockenbach (1975), Rogacheva (1992), Schmitt *et al.* (1980), Shirihai & Doherty (1990), Shirihai & Christie (1992), Simeonov *et al.* (1990), Sylvén (1978), Tubbs (1974), Weir & Picozzi (1975).



191

ssp oreophilus



ssp trizonatus



192



typical morph



pale morph



pale morph



194

dark morph



pale morph

195



dark morph



ssp lagopus

196



ssp sanctijohannis



dark morph



199



ssp menzbieri



197



♂



♀

normal morph

198



melanistic morph



200

PLATE 19

inches 12
cm 30

191. Mountain Buzzard

Buteo oreophilus

French: Buse montagnarde

German: Bergbussard

Spanish: Busardo Montañés

Other common names: Forest/Woodland/African Buzzard

Taxonomy. *Buteo oreophilus* Hartert and Neumann, 1914, Koritscha, Ethiopia.

Forms superspecies with *B. buteo* and *B. brachypterus*, and possibly also with *B. jamaicensis* and *B. ventralis*. Has been considered conspecific with *B. buteo*. Present species has alternatively been called *B. tachardus*. Race *trizonatus* may merit treatment as full species. Two subspecies normally recognized.

Subspecies and Distribution.

B. o. oreophilus Hartert & Neumann, 1914 - highlands of Ethiopia S to Tanzania and Malawi.

B. o. trizonatus Rudebeck, 1957 - S & E South Africa.



Descriptive notes. 45 cm; c. 700 g. Similar to migrant *B. buteo vulpinus*, but generally whiter below with uniform covering of large dark brown blotches. Juvenile has narrow bars across tail, and is finely streaked below on white underparts. Race *trizonatus* has pale band across breast and generally has smaller blotches or streaks; more rufous tone to upperparts.

Habitat. Montane forest patches, extending to exotic plantations and adjoining grassland, from sea-level in S South Africa to above 4500 m further N.

Food and Feeding. Mainly rodents, also gold-

en moles, reptiles, especially chameleons, and a few small birds, frogs and insects. Hunts from a perch within forest, often on the edge overlooking open habitat; drops onto prey on the ground below or snatches it from low foliage.

Breeding. Laying Mar-Jul in Uganda; Sept-Oct in Kenya; Sept-Oct in S Africa. Soars and calls above forest before nesting. Builds a large stick platform high in a forest tree, lined with green foliage. Usually 2 eggs (2-3); incubation unrecorded; chicks have white down; fledging c. 50 days; post-fledging period of up to 130 days.

Movements. In South Africa apparently breeds only in winter-rainfall area of S Cape Province, and moves N along Drakensberg escarpment to Natal and Transvaal in winter. No movements described for E Africa.

Status and Conservation. Not globally threatened. CITES II. Common in areas of most extensive habitat (South Africa, Rwanda). Vulnerable due to limited and patchy distribution of habitat, especially to forest cutting. Adopts plantations of exotic pine and eucalypt trees for nesting and hunting, which has extended range in South Africa. Not known to be affected by pesticides.

Bibliography. Allan (1992), Bataamba (1989), Britton (1980), Brown *et al.* (1982), Ginn *et al.* (1989), James (1986), Lewis & Pomeroy (1989), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Palmer *et al.* (1985), Pickford *et al.* (1989), Siegfried & Frost (1973), Steyn (1982), Tarboton & Allan (1984).

192. Madagascar Buzzard

Buteo brachypterus

French: Buse de Madagascar

German: Madagaskarbussard

Spanish: Busardo Malgache

Taxonomy. *B. brachypterus* Hartlaub, 1860, Madagascar.

Forms superspecies with *B. buteo* and *B. oreophilus* and possibly also with *B. jamaicensis* and *B. ventralis*. Has been considered conspecific with *B. buteo*. Monotypic.

Distribution. Madagascar.



Descriptive notes. 48-51 cm. Individually variable, but most individuals have greyer head than somewhat similar African *B. oreophilus* and Palearctic *B. buteo*; large white patch on belly, and different tail pattern; differs from all other *Buteo* in bluish grey cere and yellowish white legs. Sexes similar, adult with pale yellow eye. Juvenile with orange-brown eye and narrow dark bars across tail.

Habitat. All types of forest and woodland, but largely absent from the deforested central plateau. Also uses rocky slopes up to 2300 m.

Food and Feeding. Mainly small vertebrates such as frogs, lizards, snakes, rodents and

small birds, but also crabs. Hunts mainly from a prominent perch. Spends much time soaring high above home range, often in pairs.

Breeding. Laying Sept-Oct. Stick nest placed in a high fork of a tree, such as a baobab (*Adansonia*), or wedged into an epiphyte, in primary forest or adjacent shifting agriculture. 2 eggs; incubation 4-5 weeks; fledging 6-7 weeks; only a single chick usually raised.

Movements. None recorded.

Status and Conservation. Not globally threatened, CITES II. The third most common raptor on Madagascar, based on road counts of one bird every 56 km. Eight pairs occupied about 20 km² on the Masoala Peninsula. Only uncommon on deforested central plateau.

Bibliography. Benson *et al.* (1976), Berkelman (1993, 1994), Dee (1986), Langrand (1990), Langrand & Meyburg (1984), Milon *et al.* (1973), Siegfried & Frost (1973).

193. Long-legged Buzzard

Buteo rufinus

French: Buse féroce

German: Adlerbussard

Spanish: Busardo Moro

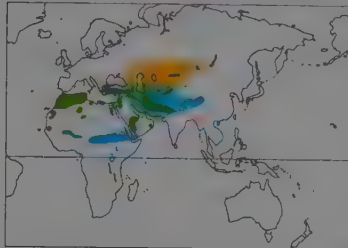
Taxonomy. *Falco rufinus* Cretzschmar, 1827, upper Nubia, Shendi, Sennar and Ethiopia.

Forms superspecies with *B. hemilasius*, with which has been considered conspecific. Race *cirtensis* may be separate species. Two subspecies recognized.

Subspecies and Distribution.

B. r. rufinus (Cretzschmar, 1827) - SE Europe and Asia Minor E through Iran and Afghanistan to NW Mongolia and S to NW India (Garhwal); winters to NE Africa and N India.

B. r. cirtensis Levaillant, 1850 - N Africa, from Mauritania to Egypt; Arabia.



Descriptive notes. 50-65 cm; male 590-1281 g, female 945-1760 g; wingspan 126-155 cm. Polymorphic, with great variation, from dark morph through reddish morph to very pale morph. Typical morph shows pale head, breast and tail contrasting with rufous belly; lacks tail barring of most other buzzards; dark carpal patches, rusty underwing-coverts; flight-feathers paler, with black trailing edge and wingtip; tarsus somewhat elongated. Female slightly larger than male. Juvenile has faintly barred tail; black on trailing edge of wing less marked. Race *cirtensis* smaller, often paler; lacks dark morph.

Habitat. Steppe, semi-desert, rocky or stony country; also open woodland or woods with clearings; from plains and foothills to mountains, breeding from coast up to at least 2500 m, and observed above 3500 m. In winter, widely scattered in variety of habitats, from desert to cultivation and wooded areas. Uses prominent perches on trees, rocks, posts, etc.

Food and Feeding. Mainly small mammals, e.g. gerbils (*Meriones*), rats, voles, young rabbits and hares, pikas; also reptiles, e.g. lizards (*Uromastix*, *Agama*) and snakes; some small birds, amphibians and large insects, e.g. locusts, grasshoppers, beetles. Rather sluggish; often waits for long periods on perch or on ground; also forages with soaring flight; hangs on wind, without beating wings, to survey ground. Can take advantage of fires to prey on escaping animals.

Breeding. Laying mainly in Mar-Apr; from Jan in some coastal regions of Morocco. Nests on cliff ledges and crags, also in trees when available; sometimes on steep slopes. Bulky nest, c. 80 cm wide, 30-50 cm deep, of twigs and sticks, lined with green leaves, wool or other materials; sometimes several nests on same crag. Both adults build nest; nest can be reused; also uses old nests of other birds. Normally 2-4 eggs (mean 2.6 Morocco); incubation at least 28 days; chicks have white first down, white to creamy white second down; fledging c. 45 days.

Movements. N African *cirtensis* sedentary and dispersive, having reached Senegal on one occasion. Eurasian *rufinus* either totally migratory, or partially migratory in N of breeding range and sedentary in S; winters from Turkey, Middle East and Arabia to Pakistan, N India and S Tibet; some birds reach N Africa, mainly Nile Valley and E sub-Saharan Africa. Leaves breeding grounds mainly in late Aug and Sept; returns mid-Mar to mid-Apr. Local movements due to droughts have been reported.

Status and Conservation. Not globally threatened. CITES II. Population sizes and trends little known. In European Russia c. 1000 pairs estimated in early 1990's. Scarce in Balkans; in 1980's, c. 200 pairs in Bulgaria (increasing), c. 20 pairs in Macedonia, and c. 60 pairs in Greece. Fairly common in Israel, with at least c. 100 pairs in early 1980's, following recovery from poisoning of 1950's. In 1980's, perhaps c. 400 pairs in Tunisia, and over 1000 pairs each in Morocco and Turkey; rare breeder in mountains of N Pakistan.

Bibliography. Ali & Ripley (1978), Berger (1987), Brown *et al.* (1982), Cheng Tso-hin (1987), Cramp & Simmons (1980), Dementiev & Gladkov (1951), Efimenko (1989), Eichécopar & Húe (1978), Flint *et al.* (1984), Gensbøl (1986), Goodman *et al.* (1989), Handrinos & Demetropoulos (1983), Hollom *et al.* (1988), Knyshatus (1993), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Meyer de Schauensee (1984), Mingozzi (1987), Patrikeev (1993), Pär (1987), Richardson (1990), Roberts (1991), Shiriha & Christie (1992), Simeonov *et al.* (1990), Strigunov (1984), Thillay (1989).

194. Upland Buzzard

Buteo hemilasius

French: Buse de Chine

German: Mongolenbussard

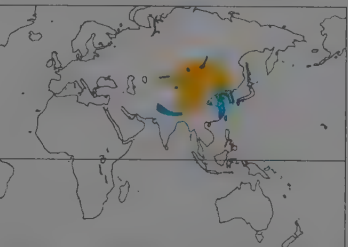
Spanish: Busardo Mongol

Other common names: Mongolian Buzzard

Taxonomy. *Buteo hemilasius* Temminck and Schlegel, 1844, Japan.

Forms superspecies with *B. rufinus*, of which has been considered a race, but ranges overlap without interbreeding. Monotypic.

Distribution. S Siberia and Mongolia E to Manchuria, and S to C China and SE Tibet. Winters in N India (Kashmir to Sikkim), E China and Korea.



Descriptive notes. 66-71 cm. Rather variable, from very dark to very pale. Larger and generally less rufous than *B. rufinus*; tarsi with smaller scales, and partially feathered. Pale morph juvenile brown above with pale feather edges, head white or pale, spotted brown; dark juvenile resembles dark morph adult.

Habitat. Open, normally dry, grassy areas, e.g. steppes, plateaux and grassy mountain slopes, with rocky areas for nesting. Tends to inhabit steeper slopes than *B. rufinus*, but also present in plains. Reaches great altitudes, e.g. over 5000 m in Tibet. Few observations in Japan, all from open agricultural lowlands.

Food and Feeding. Mainly rodents, e.g. ground squirrels, voles, gerbils, pikas and young marmots, but also young hares, to lesser degree small terrestrial birds such as larks, but sometimes larger birds, e.g. Willow Grouse (*Lagopus lagopus*). Tibetan Snowcock (*Tetrao galus tibetanus*); also birds' eggs, amphibians and insects, e.g. beetles, grasshoppers. Hunts prey from surveying flight or after spotting it from perch; sometimes catches insects on ground.

Breeding. Laying in Apr-May. Nests on ledges in rock faces, preferably protected by overhang or by vegetation; nest built with sticks and lined with wool, grass and other material. Normally 2-4 eggs, occasionally 5; replacement laying occurs; incubation c. 1 month; chicks have greyish brown down; fledging c. 45 days; 2 chicks normally fledge, although up to 4 recorded.

Movements. Mostly migratory, with some birds perhaps wintering in or near breeding areas; generally avoids snow-covered areas. In China, winters mainly N of R Yangtze, occasionally further

S. to Guangdong; records of 30 and 40 birds seen on consecutive days in NW Sichuan (C' China) in 1989; rare in winter on S slopes of Himalayas in N India and Nepal. Accidental to Japan, mainly in winter, almost certainly from Korea.

Status and Conservation. Not globally threatened. CITES II. Status very poorly known; apparently infrequent or rare throughout most of breeding range and in winter quarters, although locally abundant, e.g. in Tibet. Generally rare, but locally common in extreme S Siberia and Mongolia. Possibly subject to fluctuations related to abundance of rodents.

Bibliography. Ali & Ripley (1978), Brazil (1991), Brazil & Hanawa (1991), Cheng Tso-hin (1987), Dementiev & Gladkov (1951), Echécopar & Hùe (1978), Flint *et al.* (1984), Inskipp & Inskipp (1985), Knystautas (1993), Liu Huan-jin *et al.* (1986), Meyer de Schauensee (1984), Popov & Verzhutskii (1990), Ripley (1982), Rogacheva (1992), Sushkin (1938), Zhang Xiao-ai (1984).

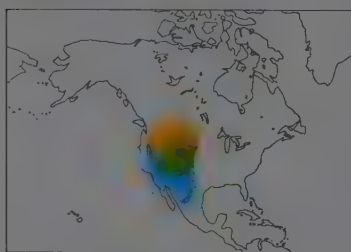
195. Ferruginous Hawk

Buteo regalis

French: Buse rouilleuse **German:** Königsbussard **Spanish:** Busardo Herrumbroso
Other common names: Ferruginous Roughleg

Taxonomy. *Archibuteo regalis* G. R. Gray, 1844. Real del Monte, Hidalgo, Mexico. Formerly placed, together with *B. lagopus*, in now obsolete genera *Triorchis* or *Archibuteo*. Monotypic.

Distribution. S Canada from S Alberta to SW Manitoba, S through WC USA to N Texas; winters S to N Mexico.



Descriptive notes. 56-69 cm; 980-2030 g, male averages 1050, female 1230 g; wingspan 122-142 cm. Largest *Buteo*. Variable, with pale and dark morphs: pale adult has rufous upperparts and white underparts with distinctive rufous thighs that form "V" in flight; dark adult sooty or rufous brown except for grey tail. Juvenile pale morph has upperparts pale brown or greyish, with underparts (including thighs) white sparsely streaked dark, and tail greyish; dark morph similar to adult.

Habitat. Arid, semi-arid and grassland regions of W North America. Avoids high altitudes and forest interiors. Common in

agricultural land. Frequents cliffs, bluffs and rocky outcrops in area.

Food and Feeding. Mainly mammals (95% by biomass, 83% by frequency), particularly rabbits, hares, ground squirrels (*Spermophilus*), pocket gophers (*Thomomys*) and prairie dogs (*Cynomys*). Fledgling passerines frequently taken on ground; adult birds as large as grouse and pheasants also caught. Reptiles, amphibians and insects form c. 3% of diet. Breeding success and abundance closely tied to cycles and oscillations of major mammal prey species. Considerable food overlap (75-95%) with sympatric *B. swainsoni* and *B. jamaicensis*. In winter, feeds more often in cultivated agricultural areas. Takes most prey by perch-hunting or from low or soaring flight; also by hovering, or on ground after aerial survey.

Breeding. Mar-Jul; in Canada, laying c. 2 weeks later than in centre of range. Disproportionately large stick nest, often more than 100 cm wide and 100-200 cm deep, with inner bowl for eggs 17-32 cm deep, lined with bark, leaves or cow or horse dung; trees or large shrubs preferred (c. 49% of nests), with (in order of frequency) cliffs, utility power poles, dirt outcrops, ground, artificial nest platforms, haystacks and derelict buildings also used; nest tree usually isolated or at edge of stand of trees; use of artificial nest platforms on poles increasing, with up to 20-60% used, depending on area. Usually 3-4 eggs (1-8); incubation 32-33 days; chicks have white down; fledging 38-40 days. Sexual maturity at 2 years. Oldest ringed bird 20 years. Clutch size, success and number of pairs nesting varies widely with food supply; as many as 89% of pairs nested in high food year, but only 43% in low food year, in same area. Average fledging rate (per total attempt) ranges from 3-0 in high food years, to 0-7 in low food years.

Movements. Some young birds disperse as soon as fledged. N birds seem to move farthest with some Canadian ringed birds found in Mexico; birds from Alberta (W Canada) winter mainly in Texas (S USA), covering c. 2100 km, with movement through plains rather than mountains.

Status and Conservation. Not globally threatened. CITES II. Local losses and apparent reduction of entire population have led to calls for listing as threatened species; not listed because of insufficient supporting data. In 1979, breeding population estimated at 2800-3600 pairs; in 1992, estimated at 3000-5600 pairs. Especially sensitive to disturbance, which causes birds to abandon during egg-laying and incubation periods. Because of habitat alterations and local losses, population extensively managed by use of artificial nest platforms.

Bibliography. Bechard *et al.* (1990), Blair & Schlotzky (1992), Bohm (1977), Busch *et al.* (1978), Call (1979), Clark, T.W. *et al.* (1989), Evans (1982), Fyfe & Olendorff (1976), Howard & Hilliard (1980), Howard & Wolfe (1976), Johnson (1990), Kochert *et al.* (1988), Konrad & Gilmer (1986), Lokemoen & Duebbert (1976), Moore, D.A. (1987), Moritsch (1985), Murphy (1978), Olendorff (1973, 1993), Palmer (1988), Powers (1981), Powers *et al.* (1975), Rainakka & Woyewodzie (1993), Restani (1989), Roth & Marzluff (1989), Schmutz, J.K. (1977, 1984, 1987), Schmutz & Fyfe (1987), Schmutz & Hungle (1989), de Smet & Conrad (1991), Smith & Murphy (1978), Smith *et al.* (1981), Snyder & Wiley (1976), Stalmaster (1988), Steinhof *et al.* (1993), Thurow & White (1983), Tomback & Murphy (1981), Wakeley (1978a, 1978b), Weston (1969), White & Thurow (1985), Woffinden (1975), Woffinden & Murphy (1977, 1983, 1989).

196. Rough-legged Buzzard

Buteo lagopus

French: Buse pattue **German:** Raufußbussard **Spanish:** Busardo Calzado
Other common names: Rough-legged Hawk

Taxonomy. *Falco Lagopus Pontoppidan*, 1763, no locality = Denmark.

Variation clinal in Palearctic, with broad intergradation zones. Race *menzhieri* sometimes merged into *kamtschatskensis*. Four subspecies normally recognized

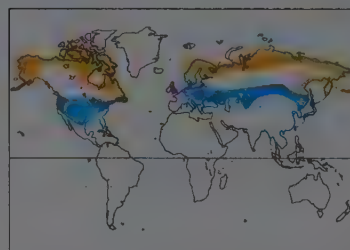
Subspecies and Distribution.

B. l. lagopus (Pontoppidan, 1763) - N Eurasia, from Scandinavia E to area of R Oh and R Yenisey; winters mainly in C Europe and C Asia.

B. l. menzhieri Dementiev 1951 - NE Asia E of R Oh and R Yenisey; winters S to C Asia, N China and Japan.

B. l. kamtschatskensis Dementiev 1931 - Kamchatka; presumably winters in EC Asia.

B. l. sanctijohannis (Gmelin, 1788) - Alaska and N Canada; winters S to C & S USA.



Descriptive notes. 50-60 cm; male 600-1377 g, female 783-1660 g; wingspan 120-150 cm. Plumage very variable, from all dark to rather pale. Conspicuous broad dark subterminal band on white tail. Female generally shows more contrasted plumage than male; just one narrow, inconspicuous bar (several in male) next to broad subterminal tailband. Juvenile paler, with single tailband broader and paler. Geographical variation clinal; races separated on size and intensity of pigmentation.

Habitat. Essentially found in tundra, mainly treeless, although also wooded tundra and even extreme N taiga, particularly in years of

lemming and vole abundance. Normally in flat lowlands; in Norway up to 1200 m or more. In winter, often in areas more modified by man, but still mainly in open terrain, e.g. prairies, cultivation, marshes; heavily dependent on abundance of rodents and availability of suitable nest-sites, basically rock faces.

Food and Feeding. Small mammals normally make up 80% or more of prey; mainly voles and lemmings in breeding range, and also many voles in winter quarters; of less importance are mice, shrews, hares, ground squirrels, pikas, weasels and even bats. To lesser extent takes small birds, particularly young birds in breeding season: from buntings and thrushes to grouse, waders and other waterbirds; importance of birds can increase when rodents scarce. Occasionally other vertebrates (including fish), insects (e.g. grasshoppers, crickets) and carrion, ranging in size from small animals through rabbits and ducks up to caribou and marine mammals. Awaits prey on perches, e.g. posts, rocks and other vantage points; may hover in flight to detect prey. Sometimes hunts crepuscularly, foraging in open areas; where inhabits woodland, forages in clearings and bogs; may visit rubbish dumps.

Breeding. Laying in May-Jun. Nests at vantage points, normally high on cliffs, rocky outcrops or riverbanks, preferring protected ledges; infrequently in trees, and occasionally on slopes. Bulky nest of sticks or twigs, lined with grass, sedges, hair and feathers; often several nests fairly close together, which can be used in turn in consecutive years. Normally 3-5 eggs (2-7), laid at interval of c. 2 days; clutch size varies with abundance of lemmings and voles, e.g. in Norway 2-3 eggs in bad years, 5-7 eggs in good years; replacement laying occurs; incubation 28-31 days per egg, almost exclusively by female; chicks have first down grey, second down darker brownish grey; fledging 34-45 days, males c. 1 week before females; independence 3-5 weeks later. Breeding success varies with food availability; on average, young from c. 50% of eggs reach fledging. First breeding probably at 2 years old. Oldest recorded bird 18 years.

Movements. Migratory, with breeding range and winter quarters usually quite separate. Date, duration and distance of migration can vary with southward extent of snow cover and abundance of rodents in breeding range; in certain years, some birds fly further S than normal winter quarters. In Europe and Asia most birds leave breeding areas from mid-Sept to early Nov, remaining in winter quarters Nov-Mar; birds return to breeding areas from late Apr to late May, although when food supply scant may make extensive nomadic movements on arrival; may also make movements in winter quarters, e.g. leaving areas with prolonged show cover.

Status and Conservation. Not globally threatened. CITES II. Widespread and fairly common in boreal regions of Holarctic, where neither species nor habitat are subject to excessive human pressure, although such pressure greater in winter quarters. Considerable fluctuations in range and numbers, but probably stable in medium and long term; accurate censuses lacking, and estimates subject to wide margins of error. Partial winter censuses suggest North American population of c. 50,000 birds in 1986; estimated c. 100,000 pairs in European Russia in early 1990's.

Bibliography. Armstrong (1983), Bieldstein (1978), Brazil (1991), Brazil & Hanawa (1991), Brown *et al.* (1982), Cade (1955), Cheng Tso-hin (1987), Clark, W.S. (1981), Cramp & Simmons (1980), Dementiev & Gladkov (1951), Echécopar & Hùe (1978), Flint *et al.* (1984), Friedmann (1950), Génsbol (1986), Hamerstrom & Weaver (1968), Handrinos & Demetropoulos (1983), Hou *et al.* (1990), Johnson (1990), Knystautas (1993), Littlefield *et al.* (1992), Martin, B.P. (1992), Mayr & Short (1970), Meyer de Schauensee (1984), Mitchell & Millsap (1990), Nankinov (1994), Palmer (1988), Paz (1987), Popov & Verzhutskii (1990), Porter (1981), Rogacheva (1992), Root (1988), Schnell (1967a, 1967b, 1968, 1969), Simeonov *et al.* (1990), Snyder & Snyder (1991), Snyder & Wiley (1976), Sutton & Parmalee (1956), Sylven (1978), Tachibana (1955), Watson, J.W. (1984).

197. Red-necked Buzzard

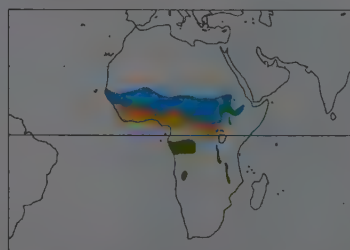
Buteo auguralis

French: Buse d'Afrique **German:** Salvadoribussard **Spanish:** Busardo Cuellirrojo
Other common names: (African) Red-tailed Buzzard(!)

Taxonomy. *Buteo auguralis* Salvadori, 1865, Ethiopia.

Monotypic.

Distribution. Sierra Leone E to Uganda and Ethiopia, and S to N Angola; outside breeding season, occurs in Sahel zone.



Descriptive notes. 35-40 cm; male 525-620 g, female 580-890 g. Head and neck chestnut, underparts either white or spotted with brown; smaller and in different habitat to *B. augur*. Juvenile shows similar differences, but is more uniform brown, becoming paler with wear.

Habitat. Forest edge and tall broad-leaved woodlands, including agricultural clearings and secondary forest.

Food and Feeding. Wide range of small animals; vertebrates predominate by weight, including rodents, snakes, chameleons and lizards, also small birds and frogs; arthropods taken prey by numbers, from termite alates to

crabs. Perches in the open for long periods, on dead trees or poles, taking most prey from the ground or occasionally from foliage. Sometimes hawks insects above bush fires.

Breeding. Laying Jan-Feb in W & NE Africa; Oct in Zaire and W Angola. Rocking and swooping display flight with shrill calling. Builds platform of sticks high in a tree, often in *Borassus* palm, rarely on cliff ledge; nowadays frequently on pylons in Ghana. 2-3 eggs; incubation plus fledging c. 50-60 days; chick has white down, with grey crown and face, cinnamon on back and wings, and long silky down on head.

Movements. Regular annual N-S migration in W Africa, moving S in Sept just after rains to breed along forest edge and woodland adjoining Guinea and Upper Congo forests. At commencement of

rains in Mar moves N into drier, more open savanna, where little studied. Movements in C & NE Africa not as obvious or well understood; possibly separate population in N Angola and SW Zaire.

Status and Conservation. Not globally threatened. CITES II. Generally common. Ability to move in conjunction with suitable habitat conditions during both breeding and non-breeding seasons offers considerable flexibility. Vulnerable to degradation of woodland but uses many secondary habitats and probably benefits from cutting of rain forest. Not known to be affected by pesticides.

Bibliography. Brown *et al.* (1982), Chapin (1932), Grimes (1987), Holman (1947), Lippens & Wile (1976), Louette (1981, 1991), Mackworth-Præd & Grant (1957-1973), Pinto (1983), Serle (1950), Serle *et al.* (1977), Snow (1978), Thiollay (1975a, 1976a, 1977b, 1978a, 1978c, 1985d).

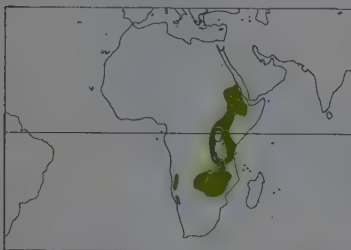
198. Augur Buzzard

Buteo augur

French: Buse augure **German:** Augurbussard **Spanish:** Busardo Augur Oriental

Taxonomy. *Falco (Buteo) Augur* Rüppell, 1836, Ethiopia. Forms superspecies with *B. archeri* and *B. rufofuscus*; all three sometimes considered conspecific, but differ on calls and coloration, showing disjunct distribution; limited overlap with *B. rufofuscus* in C Namibia. Monotypic.

Distribution. Ethiopia S to Zimbabwe and W to S Angola and N & C Namibia.



Descriptive notes. 55-60 cm; 1097-1303 g; wingspan 132 cm. Broad wings with black trailing edge to white underside sometimes mistaken for *Circus pectoralis*, but short tail bright rufous; *Terathopus ecaudatus* has black underparts. In E African part of range, 10-25% comprise a melanistic morph; more numerous in areas of higher rainfall. Female similar, but larger; typically has more extensive black markings on throat. Juvenile with dark streaks on throat and breast unlike plain underparts of juvenile *B. rufofuscus*.

Habitat. Mountainous and hilly country covered in forest patches, open woodland, savanna and grassland, to over 5000 m, including some isolated hills in otherwise flat terrain.

Food and Feeding. Mainly lizards, snakes, rodents and mole-rats, together with some small birds, insects and carrion. Hunts mainly from a rock or tree perch, sometimes from soaring, hovering or gliding flight, rarely while walking about on the ground. Hunts both within forest or woodland, and over open habitats.

Breeding. Laying spread over all months in E & NE Africa (peak Jun-Sept); May in Zaire; Jul-Oct in S & C Africa. Spectacular aerial flight and calling display. Builds a substantial stick nest in a tree, or on a cliff ledge, or on a tree protruding from a cliff, lined with green leaves. Usually 2 eggs (2-3); incubation 39-40 days; chicks have pale grey down; elder chick usually kills younger sibling; fledging 48-55 days; some polygamy recorded.

Movements. Resident and sedentary; some movements reported outside breeding season in parts of E Kenya, Nov-Jan. Vagrant to S Zaire.

Status and Conservation. Not globally threatened. CITES II. Common in E Africa, with nests less than 1 km apart, and in suitable habitat in S Africa, with approximate density of 1 pair/17 km². Vulnerable to extensive afforestation of grassland habitat, or to lowered carrying capacity through overgrazing. However, adapts well to human settlement and extends onto grassland using small exotic plantations for nesting and roosting. Not known to be affected by pesticides.

Bibliography. Bataamba (1989), Benson & Benson (1975), Britton (1980), Brooke (1975), Brown *et al.* (1982), Ginn *et al.* (1989), Lendrum (1979), Lendrum & Lendrum (1982), Lewis & Pomeroy (1989), Louette (1991), Maclean (1993), Pickford *et al.* (1989), Snow (1983), Snow (1978), van Someren (1956), Steyn (1982), Weaving (1972).

199. Archer's Buzzard

Buteo archeri

French: Buse d'Archer **German:** Archerbussard **Spanish:** Busardo Augur Somali

Taxonomy. *Buteo jakal archeri* W. L. Sclater, 1918, Waghar, Somalia. Forms superspecies with *B. augur* and *B. rufofuscus*; all three sometimes considered conspecific, but differ on calls and coloration, showing disjunct distribution. Monotypic.

Distribution. Highlands of N Somalia.



Descriptive notes. 50-55 cm. Chestnut underparts quite distinct from larger, white-breasted neighbour *B. augur*. Rufous feathers on upperparts and white throat with black streaks also notable; some birds have blackish sides to upper breast. Juvenile pale rufous to whitish below with sparse streaking on upper breast.

Habitat. Mountainous and hilly savanna.

Food and Feeding. Unstudied, probably various small vertebrates and arthropods. Likely to hunt from perch, or from soaring flight on its broad wings.

Breeding. Laying at end of dry season, late Mar-early Apr. 1-2 eggs; further details un-

recorded. Chicks often in nest during start of rainy season.

Movements. None recorded, unlikely within limited range.

Status and Conservation. Not globally threatened. CITES II. Status uncertain. Appears vulnerable, due to small range and possibility of rapid degradation of habitat by cutting of trees and overgrazing. Virtually unstudied; on previous information lumped with related species *B. augur* and *B. rufofuscus*. Not known to be affected by pesticides.

Bibliography. Archer & Godman (1937), Ash & Miskell (1983), Brooke (1975), Brown *et al.* (1982), Grossman & Hamlet (1964), Snow (1978).

200. Jackal Buzzard

Buteo rufofuscus

French: Buse rounoir **German:** Felsenbussard **Spanish:** Busardo Augur Meridional

Taxonomy. *Falco rufofuscus* J. R. Forster, 1798, South Africa. Forms superspecies with *B. augur* and *B. archeri*; all three sometimes considered conspecific, but differ on calls and coloration, showing disjunct distribution; limited overlap with *B. augur* in C Namibia. Monotypic.

Distribution. South Africa, S & C Namibia, Lesotho, Swaziland, S Mozambique and S Botswana.



Descriptive notes. 45-55 cm; male 865-1080 g, female 1150-1695 g; wingspan 132 cm. Bold patterning distinctive in flight, with black and chestnut body against rufous tail and broad black and white wings. Individually variable. Sometimes mistaken for larger, narrow-winged *Terathopus ecaudatus*. Morph exists with pale, almost white, breast patch recalling *B. augur*. Juvenile pale rufous brown below.

Habitat. Open steppe and grassland, especially in hilly and mountainous terrain.

Food and Feeding. Mainly small mammals up to size of young hyrax, birds to size of francolin, and large snakes and lizards. Also takes some insects, and carrion important in winter. Hunts for much of the time on the wing, soaring and hanging expertly in updraughts and strong, gusty winds. Stoops at prey from foraging flight, or hunts from a perch.

Breeding. Laying May-Oct. Builds a large stick nest lined with leaves, usually on a cliff ledge, sometimes in a tall tree. Usually 2 eggs (2-3); incubation c. 40 days; chick has white down; elder chick often kills younger sibling; fledging 50-53 days.

Movements. No regular movements described, but some suggested by long distance (640 km) ringing recoveries of adults and juveniles, and appearance of birds on open plains away from nesting areas in non-breeding season.

Status and Conservation. Not globally threatened. CITES II. Common, at 1 bird/62 km on road transects through karoid steppe, and at densities of 1 pair/17-30 km² in mountainous Transvaal habitats in South Africa, where estimated 1100 pairs. Prefers areas of low human density and extensive small-stock farming. Not known to be affected by pesticides.

Bibliography. Barnard (1986), Brooke (1975), Brown *et al.* (1982), Ginn *et al.* (1989), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Norgar & Lasbrey (1953), Pickford *et al.* (1989), Schmitt *et al.* (1987), Snow (1978), Steyn (1982), Tarboton & Allan (1984).



Genus *MORPHNUS* Dumont, 1816

201. Guiana Crested Eagle

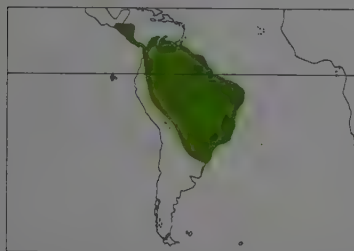
Morphnus guianensis

French: Harpie huppée German: Würgadler Spanish: Arpía Menor
Other common names: Crested Eagle

Taxonomy. *Falco guianensis* Daudin, 1800, Cayenne.

Includes *M. taeniatus*, a variant of dark morph with heavily banded underparts. Monotypic.

Distribution. Guatemala and Honduras through Central America to Colombia and S to Paraguay, extreme NE Argentina (Misiones) and S Brazil; W of Andes, ranges S only to Serranía de Baudó (WC Colombia).



Descriptive notes. 71-84 cm; 1750 g. A large, lanky eagle with prominent nuchal ruff and long, black occipital crest; polymorphic, with two distinct colour morphs, and several intermediate morphs. Pale morph has head, neck and breast ashy grey to brown; above blackish brown overall; belly and underwing-coverts white, finely barred cinnamon; tail black, narrowly tipped white and boldly barred pale greyish. Dark morph similar above, but all black below, or black with narrow white barring. Iris dark brown to grey or greyish yellow, cere black, legs and feet dull yellow. Pale morph differs from *Harpia harpyja* in smaller size, bill and talons, slimmer build, relatively longer tail and lack of dark breast band. Female similar to male, but substantially larger. Immature blackish above mottled white; head, neck and underparts white, crest tipped black; tail with narrower, less conspicuous bands than in adult; takes several years to reach adult plumage, gradually becoming darker.

Habitat. Lowland tropical and subtropical forest, including gallery forests in S of range. Occurs up to 600 m, and perhaps up to 1000 m, in Colombia.

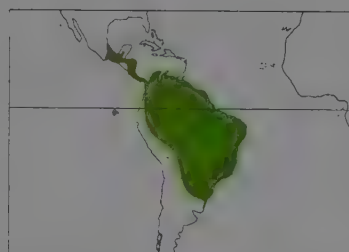
Food and Feeding. Snakes, both arboreal and terrestrial; small to medium-sized mammals, especially arboreal rodents and marsupials and kinkajous (*Potos flavus*); also birds and a tree frog (probably *Phyllomedusa*). Porcupine quills impaled inside stomach of a bird found starving. Seen attacking Grey-winged Trumpeters (*Psophia crepitans*), Guianan Cocks-of-the-rock (*Rupicola rupicola*) on a lek, and monkeys. Two kinkajous (a strictly nocturnal species) were delivered to nest an hour or more apart one morning. One bird, seen gliding extremely slowly, with tail and wings fanned wide, c. 50 m over canopy, was perhaps hunting. Often soars over forest; said to sit still on high perch for long periods.

Breeding. Very few nests discovered, and only 1 studied in detail. Hatching in Apr (late rainy season) at Manaus, NC Brazil; nest trimming in Mar in Venezuela. Bulky stick nest in the crotch of a large tree. 2 eggs, but only 1 young raised. Vocal around the nest. 1 copulation witnessed in the nest, without courtship feeding; male provides food during incubation and first month after hatching, when female begins to deliver food, including larger prey items. Male calls on approaching nest, delivers food and remains only a few minutes; female very rarely returns to nest without food or fresh greenery with which to trim nest.

Movements. Apparently sedentary.

Status and Conservation. Not globally threatened. CITES II. Formerly red-listed in category Rare, but currently considered near-threatened. Sparsely distributed throughout extensive tropical forests and gallery forests in S of range. Not immediately threatened, but large size and low population densities make species particularly sensitive to the hunting pressure that accompanies any human incursions into forests. Many old records from Chocó region (NW Colombia), which is now widely deforested; similar extensive deforestation in Central American parts of range suggest that local contraction of range or serious declines in population density have already occurred. Thought to be able to sustain small amounts of human pressure slightly better than *H. harpyja*, although apparently rarer than that species in several areas, e.g. Venezuela, Surinam.

Bibliography. Belton (1984), Bierregaard (1985), Blake (1977), Collar & Andrew (1988), Ellis & Whaley (1981), Friedmann (1950), Haverschmidt (1968), Hilty & Brown (1986), Kiff *et al.* (1989), King (1978/79), Lehman (1943), Meyburg (1986), Monroe (1968), Olrog (1985), Parker *et al.* (1982), de la Peña (1992), Phelps & Phelps (1958), Pinto (1964), Ridgely & Gwynne (1989), Sick (1985a, 1993), Stiles & Skutch (1989), Terborgh (1983), Thiollay (1984, 1989b), Tostain *et al.* (1992), Trail (1987), Wetmore (1965).



head and thighs as adult, tail bands reduced to 4-5. **Habitat.** Lowland tropical forest; normally below 800 m, but single record at 1600 m in Colombia. Occurs in uninterrupted expanses of forest, but will nest in areas where high-grade forestry has been practised, and will hunt through forest patches in a pasture/forest mosaic. Apparently rarely, if ever, soars; occasionally conspicuous while sunbathing on prominent emergent perches in early morning.

Food and Feeding. Preys on large, powerful vertebrates, including adult howler (*Alouatta*), capuchin (*Cebus*) and saki (*Pithecia*, *Chiropotes*) monkeys, two-toed sloths (*Choloepus*) and three-toed sloths (*Bradypus*), opossums (*Didelphus*), tayra (*Eira barbara*), and porcupines (*Sphiggurus spinosus*), anteaters, coatimundis and kinkajous; also reptiles, including snakes, tupinambis and iguanas, and amphibiaenids. Some terrestrial mammals taken, including agoutis, domestic pigs, and young brocket deer (*Mazama*). Birds recorded include parrots, curassows, Hyacinth Macaws (*Anodorhynchus hyacinthinus*) and Red-legged Seriema (*Caracara cristata*). Sloths particularly important, constituting up to one third of biomass of prey delivered; reason may be that sloths climb to tops of trees to warm up in early morning and are therefore conspicuous when present species actively hunting. In Guyana, cebid monkeys, especially adults, are most important primate prey. In Argentina, prey includes opossums, tayras and porcupines. Adults often return to nest with only portions of their prey. Females take larger prey (2.7-9 kg) than males (0.5-2.3 kg); males bring to nest pieces of prey estimated to weigh c. 1 kg, whereas females probably carry pieces up to 4 kg. One individual caught a subadult male red howler monkey, estimated to weigh c. 7 kg. Much hunting takes place around forest edge and clearings, and in the canopy itself; often waits beside rivers and salt-licks. Rapid attack, following which prey may be taken to top of tree; if too large, usually carried to fallen tree. Despite huge size, flies through forest with great agility. Excellent hearing may help in locating prey.

Breeding. Most of data from single nest-site studied over several years, but 13 nests now under observation by the Peregrine Fund. Laying in Jun (rainy season) in Guyana; Sept-Nov in Goiás (C Brazil); chicks in Nov in Argentina. Bulky nest up to 150 cm wide, built of large sticks, usually in enormous emergent trees, 50-75 m tall; in Guyana, silk-cotton trees (*Ceciba pentandra*), often towering above surrounding forest, offer ideal nest-sites; in Venezuela, often nests in Lecythidaceae; in Panama nests in Bombacaceae; nests in *Mauritia* palms also reported. 2 eggs (one record of 3); apparently only one young raised, as no nests found with two advanced young; incubation 56 days (in middle of rainy season); chick has dirty white down; fledging variously c. 140 days, or c. 6 months; juvenile remains within 100 m of nest for at least 12 months, so that adults can breed only every third year, when successful. 97% of incubation by female; male brings prey to nest once a week during incubation, and twice a week during first half of nestling period.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES I. Formerly red-listed in category Rare, but currently considered near-threatened. Sparsely distributed throughout extensive range, and generally rare. Has disappeared from large parts of former range, notably from most of N & C Central America; in Colombia, rare and local; in Brazil, still reasonably common in Amazonia, but rare elsewhere, with major decline (and possible extinction) in Rio Grande do Sul; persists in N Argentina, where 3 recent nest records. Former range has undoubtedly been reduced to some extent due to hunting and deforestation. Accurate knowledge of breeding density and home range size essential for planning conservation of species; published estimates of home range size based mostly on speculation. Peregrine Fund has brought various birds together in captive breeding programme; satellite transmitters now placed on 5 young birds, but no adults to date. Active nests reported to be as close together as 5 km in Venezuela, and only 3 km apart in both Guyana and Panama. Obviously susceptible to extensive deforestation, and consequently now missing from parts of former range in S Brazil, but could perhaps survive in disturbed forests or even perhaps forest mosaics, if large size and boldness in face of humans did not make them irresistible targets for hunters. Low overall population densities and slow reproductive rates make shooting the most significant threat over entire range; of the 5 young carrying radio transmitters in Venezuela, 1 has already been shot.

Bibliography. Alvarez (1993, 1994), Anon. (1991c), Belton (1984), Blake (1977), Bond (1927), Chebez *et al.* (1990), Collar (1989), Collar & Andrew (1988), Contreras *et al.* (1990), Eason (1989), Foerster (1972), Fowler & Cope (1964), Gochfeld *et al.* (1978), Hilty & Brown (1986), Iñigo-Elias *et al.* (1987), Izor (1985), King (1978/79), Malingreau & Tucker (1988), Meyburg (1986), Monroe (1968), Peres (1990), de la Peña (1992), Pinto (1964), Renig (1977, 1978), Ridgely & Gwynne (1989), Ruschi (1979), Sherman (1991), Sick (1985a, 1993), Slud (1964), Stiles & Skutch (1989), Thiollay (1984), Tostain *et al.* (1992), Voous (1969), Wetmore (1965).

Genus *HARPIA* Vieillot, 1816

202. Harpy Eagle

Harpia harpyja

French: Harpie féroce German: Harpyie Spanish: Arpía Mayor

Taxonomy. *Vultur Harpyja* Linnaeus, 1758, Mexico.

Only close relative appears to be *Morphnus guianensis*. Monotypic.

Distribution. S Mexico (from S Veracruz, Oaxaca and apparently Campeche) through Central America to Colombia, then E through Venezuela to the Guianas and S through E Bolivia and Brazil to extreme NE Argentina (Misiones).

Descriptive notes. 89-105 cm; male 4000-4800 g, female 7600-9000 g; wingspan up to 200 cm. A truly massive raptor. Head greyish with a dark, divided crest; relatively short, rounded wings, with long, barred tail. All dark above; very dark breast band separating grey head from white belly;

Genus *HARPYOPSIS* Salvadori, 1875

203. New Guinea Eagle

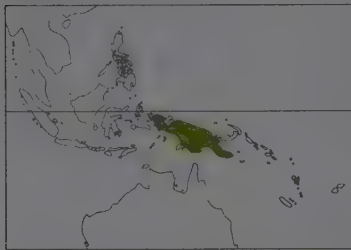
Harpypopsis novaeguineae

French: Aigle de Nouvelle-Guinée German: Papuaadler Spanish: Arpía Papúa
Other common names: New Guinea Harpy Eagle, Kapul Eagle

Taxonomy. *Harpypopsis novaeguineae* Salvadori, 1875, Andai, Arfak Peninsula, New Guinea.

Traditionally considered to be related to *Harpia* and *Pithecopaga*, but possibly part of old endemic Australasian clade (see page 55). Monotypic.

Distribution. New Guinea.



Descriptive notes. 75-90 cm; 1600-2400 g; wingspan of female 157 cm. Large forest eagle with erectile crest and facial ruff, and long bare legs; proportioned like giant *Accipiter*. Female larger than male. Juvenile similar, but washed brown on underparts; eyes and bill darker; tail has more and narrower bars.

Habitat. Rain forest from lowlands to 3200 m; local in gallery forest, in woodland and monsoon scrub. Largely confined to undisturbed forest, but visits nearby clearings and native gardens. Nests in forest.

Food and Feeding. Mainly terrestrial and arboreal mammals, including cuscus (*Phalanger*), possum (*Pseudocheirus*), wallabies (*Dorcopsis*, *Dorcopsulus*, *Thylogale*), tree-kangaroo (*Dendrolagus*), giant rats (*Mallomys*, *Uromys*), young dogs and pigs. Also birds and reptiles, including snakes and monitor lizards (*Varanus*). Contrary to some reports, all foraging diurnal and species does not soar to hunt. Forages from series of perches in forest canopy; searches for several minutes, peering about and using facial ruff to assist in detection of prey by sound; if prey not detected, flies 50-60 m through canopy, as far as 500 m low over canopy, to new perch. Swoops from perch onto prey below, if necessary pursuing it by running and leaping along ground. Also clambers among branches for arboreal prey; flushes prey from arboreal nests in epiphytes by striking with wings or tearing epiphytes apart with feet; shakes foliage to induce mammals to peer from hollows; uses feet to extract prey from holes.

Breeding. Apparently from late wet season through dry season (austral autumn to spring); specimen in breeding condition in Jun; active nest Apr-May; large nestling late Aug. Solitary. Large stick nest built high (20 m) in emergent tree, e.g. *Eugenia*, with no low branches; nest used for many years. Two records of single nestlings. Longevity more than 30 years in captivity. No further information.

Movements. Presumably sedentary.

Status and Conservation. VULNERABLE. CITES II. Low population density and apparently low reproductive rate; few detailed observations by ornithologists, and biology poorly known. Plumage avidly sought by natives armed with shotguns. Now rare or absent in areas of heavy (illegal) hunting pressure; also threatened by deforestation in lowlands.

Bibliography. Beehler (1985), Beehler *et al.* (1986, 1992), Bell (1984), Brown, L.H. (1976b), Clapp (1987), Coates (1985), Collar & Andrew (1988), Diamond (1972), Majnep & Bulmer (1977), Mayr & Gilliard (1954), Osborne & Osborne (1991), Peckover & Filewood (1976), Rand & Gilliard (1967), Schulz (1987).

Genus *PITHECOPHAGA* Ogilvie-Grant, 1896

204. Great Philippine Eagle

Pithecopaga jefferyi

French: Aigle des singes **German:** Affenadler **Spanish:** Aguila Monera
Other common names: (Philippine) Monkey-eating Eagle, Philippine Eagle

Taxonomy. *Pithecopaga jefferyi* Ogilvie-Grant, 1896, Samar, Philippine Islands.

Monotypic genus of uncertain affinities. Monotypic.

Distribution. Larger islands of N & E Philippines, on Luzon, Leyte, Samar and Mindanao.



Descriptive notes. 86-102 cm; 4700-8000 g. Huge eagle with large deep bill and long nape feathers forming ragged crest. Juvenile similar to adult, but with white edging to back feathers and upperwing-coverts.

Habitat. Primary dipterocarp forest and residual gallery forest up to 2000 m. Also patches of forest in cleared areas.

Food and Feeding. Feeds mainly on flying lemurs and palm civets; less often monkeys; wide variety of other prey, e.g. rats, flying squirrels, snakes, monitor lizards, birds (including hawks, owls and hornbills) and bats; a deer's leg also recorded. Hunts inside forest from perches in canopy; regularly moves gradually downhill from perch to perch; after reaching bottom, soars back to top to begin again. Co-operative hunting of pair reported: one bird distracts troop of monkeys, allowing other to sneak up and take one from behind.

Breeding. Breeding activity begins in Sept; laying Oct-Dec. Huge nest built by pair 30+ m up in canopy of enormous tree; nest usually placed on epiphytic fern. Invariably 1 egg; incubation 60-61 days, by both sexes, but mainly by female; chick has white down; fledging c. 23-24 weeks; chick remains dependent on parents for another year or more. Nestling fed, brooded and guarded by female, while male hunts; female begins hunting in latter part of nestling period. As result of long post-fledging dependency, successful breeding cycle usually lasts two years; unsuccessful pairs will re-nest.

Movements. Sedentary.

Status and Conservation. ENDANGERED. CITES I. Probably less than 200 individuals remain in wild. At present, healthiest population thought to occur in mountains of Sierra Madre (N Luzon), which hold greatest remaining expanses of forest in Philippines; former stronghold in Mt Apo National Park (Mindanao) currently suffering intense human pressure; small population of only a few pairs at Mt Katanglad (Mindanao) receives some protection, including vigilance of one nest, and in recent years (e.g. 1993) this has assured successful breeding. Throughout range, main factors in population reduction are: loss of forest habitat; shooting for trophies; and capture of eagles for pets. Most of lowland forest habitat now cleared; much of hill and low mountain habitat currently in process of being cleared. In some cases, pair surprisingly hanging on, in spite of forest clearance from most of their territory. Two chicks produced by captive breeding, in preparation for future reintroduction; however, as long as clear-felling of forests continues, together with subsequent

human settlement of cleared land, future of this emblematic species remains precarious. Other conservation initiatives to save species include local public awareness campaigns.

Bibliography. Brown, L.H. (1976b), Brown & Amadon (1968), Collar & Andrew (1988), Dickinson *et al.* (1991), DuPont (1971), Gonzales (1968), Kennedy (1977, 1981, 1983, 1985), King (1978/79), Krupa (1989), Lambert (1993), Lewis, R.E. (1986), McGregor (1909-1910), Meyburg (1986), Rabor (1977), Rand & Rabor (1960), Salvador (1994), Shuker (1993).

Genus *ICTINAETUS* Blyth, 1843

205. Indian Black Eagle

Ictinaetus malayensis

French: Aigle noir **German:** Malaenadler **Spanish:** Aguila Milana
Other common names: (Asian) Black Eagle

Taxonomy. *Falco malayensis* Temminck, 1822, Indian Archipelago = Java.

Monotypic genus of disputed affinities (see page 55). Two subspecies recognized.

Subspecies and Distribution.

I. m. perniger (Hodgson, 1836) - N India and Nepal; also S India (W & E Ghats, Orissa) and Sri Lanka.

I. m. malayensis (Temminck, 1822) - Burma, SC & SE China (Yunnan, Fujian) and Taiwan, S through Indochina and Malay Peninsula to Greater Sunda, Sulawesi and Moluccas; possibly also Banggai and Sula Is.



Descriptive notes. 67-81 cm; 1000-1600 g; wingspan 164-178 cm. Medium-sized black kite-like eagle; large paddle-shaped wings and long tail distinctive. Juvenile dark brown above, streaked on underparts. Race *perniger* slightly larger.

Habitat. Forested hills and mountains from sea-level up to 3100 m; often around forest edge, clearings and second growth.

Food and Feeding. Prey includes birds, especially nestlings, lizards, small mammals, frogs, bats and large insects; also birds' eggs. Hunts on wing with kite-like flight, sailing effortlessly and gracefully over tree tops and

grassy slopes. Foot structure, with short outer toe and less curved talons, thought to be specialized for snatching prey, including bird's nests, from tree tops.

Breeding. Season varies: Nov-Jan in S India; later in N India; Apr-Aug in Java; young bird in nest during Jul in Sulawesi; occupied nest in Aug in Sumatra. Large nest built by pair in crown of large tree in forest, often on slope; lined with green leaves. Display flights include spectacular diving plunge of 300 m or more, with wings folded into teardrop shape; more usually, undulating flight and chasing flights, the latter similar to those of *Milvus* kites. Usually 1 egg, very rarely 2. No further information available.

Movements. Mainly sedentary. Vagrant to Pakistan, where has bred.

Status and Conservation. Not globally threatened. CITES II. Widespread, usually uncommon to rare, but locally common; fairly common in Nepal; not uncommon, at any rate in past, in Chin Hills of NE Burma. Main threat is loss of forests.

Bibliography. Ali & Ripley (1978), Amadon (1982a), Bishop *et al.* (1994), Brown, L.H. (1976b), Cheng Tso-hin (1987), Deignan (1945), Henry (1971), Humphrey & Bain (1990), Inskipp & Inskipp (1985), King *et al.* (1975), MacKinnon (1988), van Marle & Voous (1988), Medway & Wells (1976), Meyer de Schauensee (1984), Roberts (1991), Round (1988), Smythies (1981, 1986), Stresemann (1940a), White & Bruce (1986).

Genus *AQUILA* Brisson, 1760

206. Lesser Spotted Eagle

Aquila pomarina

French: Aigle pomarin **German:** Schreiadler **Spanish:** Aguila Pomerana

Taxonomy. *Aquila Pomarina* C. L. Brehm, 1831, Pomerania.

Closely related to *A. clanga*, but specific status undoubted; recently confirmed by morphological and molecular genetic studies; these two sometimes considered to form superspecies. Present species may also be closely related to *A. wahlbergi*, but more research needed. In past, Indian race, *hastata*, often regarded as independent species, and its taxonomic status requires further study. Two subspecies recognized.

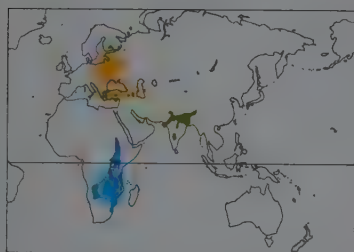
Subspecies and Distribution.

A. p. pomarina C. L. Brehm, 1831 - C, E & SE Europe through Turkey and Caucasus to S Caspian lowlands; E limit not well known. Winters in S Africa and perhaps E Africa.

A. p. hastata (Lesson, 1834) - India (mainly N), Bangladesh, and perhaps also N Burma and Pakistan.

Descriptive notes. 57-64 cm; c. 1100-2000 g; wingspan 145-170 cm. In field, perched bird appears rather uniform chocolate brown. In flight, most adults have upperwing-coverts paler than rather dark flight-feathers, but much individual variation; less conspicuous contrast between pale underwing-coverts and flight-feathers; these characteristics usually allow distinction from adult *A. clanga*. Differs from *A. nipalensis* in flight, by lack of barring on primaries and tail. Pale morph, variously named "*fulvescens*", "*fulviventris*" or "*pallida*", is very rare. Juvenile brown like adult, but generally darker, with yellow nape patch; spots on upperwing-coverts smaller and narrower than in immature *A. clanga*; spots retained till bird three years old, gradually diminishing. Race *hastata* has slightly longer wings and tarsi and browner iris; juvenile lacks spotting.

Habitat. Breeds near forest edges, preferring moist woods near meadows and fields; less dependent on bogs and water than *A. clanga*, and more adapted to cultivated areas. Highest breeding densities



in lowlands, but also breeds in dry mountain forests in Carpathians, Balkans, Anatolia and Caucasus, up to 2200 m.

Food and Feeding. Mammals, reptiles, amphibians, birds and some insects. In C Europe, mainly small mammals, especially voles (*Microtus*); also, to some extent, small to medium-sized birds, and many amphibians, mainly *Rana temporaria*, and reptiles. In humid lowland areas, amphibians can make up 42% of prey. In Slovakian hills, mammals form 85% of prey; in Greece, diet consists mainly of snakes (70%), especially *Natrix natrix*, with some birds, lizards and insects; in

Georgia, mammals (29%), reptiles (25%) and amphibians (34%) almost equally important, whereas birds only found in 8% of cases. In Indian race, mammals dominant (47%), mainly rats (*Millardina melitoda*) and palm squirrels (*Funambulus pennanti*), followed by birds (33%), reptiles (16%) and amphibians (3%). Carrion taken only rather rarely. On wintering grounds, diet apparently consists largely of Red-billed Quelea (*Quelea quelea*) nestlings and swarming termite alates; also small mammals and frogs. Mainly hunts in open areas, like *A. clanga*, using three different techniques: soaring c. 100 m high and diving down; still-hunting from perch; or walking on ground.

Breeding. In C Europe, laying in late Apr and early May, fledging in late Jul and early Aug. Occupied nests well spaced out, but in suitable habitat may be under 1 km apart. Almost always on trees, in most cases 12-15 m high, sometimes only 4-5 m, or as much as 30 m; extremely rarely on the ground. Normally only few hundred metres from edge of forest. Large stick nest, 50-150 cm in diameter; nest cup c. 30 cm wide, lined with green twigs or sometimes grass. Erynes often reused over several years, or up to 10 years consecutively. Normally 2 eggs, sometimes 1, rarely 3; incubation averages 38-85 days (36-41); chicks have greyish white down; second chick normally dies as result of cannibalism, and only extremely rarely do both young survive to fledging, without human intervention; fledging 8 weeks, but 11 weeks in single well studied case of race *hasitata*. Average 0.5-0.7 young fledge per clutch laid. Sexual maturity probably at 3 or 4 years; oldest ringed bird 26 years old.

Movements. Migratory; highly dependent on soaring and thus thermals, avoiding large bodies of water. C European birds leave around mid-Sept; European birds migrate over Bosphorus, Israel and Suez, where well studied, but migration in Africa little understood. A satellite-tracked juvenile covered 6000 km from Latvia to Sudan in barely a month, remaining there for over 6 weeks, before continuing to Kenya. Few birds cross sea from Italy and S Greece to N Africa. Adults arrive at breeding grounds in Apr. Race *hasitata* apparently not migratory.

Status and Conservation. Not globally threatened. CITES II. Has disappeared from much of former range in W, e.g. W Germany, or become very rare, e.g. E Germany, former Yugoslavia, Greece. Total population in mid-1980's estimated at c. 100,000 birds: 120 pairs in Germany; 3000-3500 birds in Byelorussia (1990's); 1300 in Poland; 1000 in Latvia; 500 in Lithuania; 150-200 in Estonia; 500 in Slovakia; 150 in Hungary; 70 in Greece; 220-250 in Ukraine; 50-80 pairs in Azerbaijan (1990's); and 85-90 in Georgia. High counts in Israel do not correspond to known breeding populations; E extent of range in Russia requires investigation. Problems include: habitat alteration, mainly drainage of forests and meadows; and hunting. Hunting particularly important during migration, especially in Syria and Lebanon, where hundreds or thousands are shot annually. International Symposium held on present species in Poland in 1991. Productivity can be increased artificially by preventing loss of second chick due to cannibalism. Race *hasitata* endangered; in Bangladesh, Burma and Pakistan, extinct or almost extinct; in India, extremely reduced and patchy distribution. Only recent nest record of this race was in Keoladeo National Park, Bharatpur, in 1986; prior to this, just 3 records of nesting more than 80 years ago.

Bibliography. Abuladze (1994a), Ali & Ripley (1978), Banzhaf (1938), Baumgart (1979, 1980, 1994), Bergmanis (1994), Bergmanis *et al.* (1990), Brooke *et al.* (1972), Brown, L.H. (1976b), Brown *et al.* (1982), Christensen & Sorensen (1989), Cramp & Simmons (1980), Danko (1986, 1990), Dementiev & Gladkov (1951), von Dohay (1934), Dovrat (1980, 1982), Drobels (1994), Flint *et al.* (1984), Forsman (1991), Gensbol (1986), Gentz (1965, 1967), Geyr von Schweppenburg (1913), Ginn *et al.* (1989), Golodushko (1958, 1959, 1961), Goodman *et al.* (1989), Gorban (1994), Hallmann (1986), Handrinos & Demetropoulos (1983), Haraszyth *et al.* (1994a, 1994b), Heinrich (1951), Hoffmann (1938), Janossy (1985), Kalaber (1974), Kislenco (1983), Knystautas (1993), Kouzmanov (1994), Likhachev (1957), Mackworth-Præd & Grant (1957-1973), Matthes & Neubauer (1977, 1987, 1989), Meyburg (1968, 1970, 1971, 1973, 1974a, 1974b, 1978a, 1978b, 1991), Meyburg & Meyburg (1988), Meyburg, Mizera & Neumann (1992), Meyburg, Scheller & Meyburg (1993), Mundt & Uhlig (1994), Neubauer (1991), Palashy & Meyburg (1973), Paz (1987), Pcola (1991), Pearson & Meadows (1979), Pererva (1989), Prakash (1994), Reistetter (1991), Rodziewicz (1994), Schneider-Jacoby (1994), Shirihai & Christie (1992), Siewert (1932), Simeonov *et al.* (1990), Sládek (1955, 1957, 1959a, 1959b, 1959c, 1993), Smythies (1986), Svehlik & Meyburg (1979), Svensson (1975, 1987), Thiollay (1989c), Uhlig (1994), Van de Weghe (1978), Vlachos (1989), Vlachos & Papageorgiou (1994), Volke (1994), Wendland (1932, 1951, 1958, 1959), Zhezhirin (1969).

207. Greater Spotted Eagle

Aquila clanga

French: Aigle criard

German: Schelladler

Spanish: Aguila Moteada

Other common names: Spotted Eagle

Taxonomy. *Aquila Clanga* Pallas, 1811, Russia and Siberia.

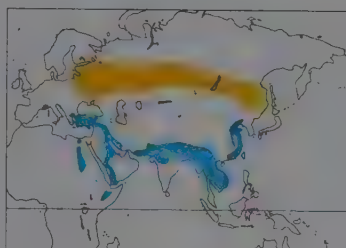
Sometimes considered to form superspecies with *A. pomarina*. Monotypic.

Distribution. EC Europe E through Russia to S USSR and Manchuria; isolated populations in N Iran and NC India. Winters from S Europe, NE & E Africa and Middle East through N Pakistan to S & E China and Indochina.

Descriptive notes. 60-70 cm; 1500-2500 g; wingspan 155-180 cm. Rather uniform dark brown to black, with strong purplish gloss on upperparts, especially in fresh plumage. Slightly larger than very similar *A. pomarina*, but overlapping in size; generally darker; wing-coverts contrast little or not at all in colour with flight-feathers. Tail and outer primaries not barred as in *A. nipalensis*. Bill size and length of middle toe (without talon) also help to distinguish from congeners. Pale morph, '*fulvescens*', very rare. Female only slightly larger than male. Juvenile and immature easily recognizable with white to yellow spots on scapulars, back and upperwing-coverts; spots larger and more numerous than in *A. pomarina*, sometimes almost obliterating dark brown background; juvenile lacks pale nape patch of *A. pomarina*.

Habitat. Large wet forests bordering humid meadows, bogs, marshes and other wetlands. Breeding mainly in lowlands, but sometimes in forests in mountains, up to 1000 m above sea-level.

Food and Feeding. Very variable, depending on availability of prey species. Mainly small mammals, amphibians, lizards, snakes, small fish, carrion and sometimes insects. In W Russia; 53% small mammals and 45% birds, in Oka Reserve; and 58% mammals, mostly voles (*Microtus*



analys). 35% birds, 3-6% reptiles, near Tula. Diet generally similar to that of *A. pomarina*, but often takes more and larger birds. Forages by soaring c. 100 m high and diving down, still-hunting from perch, or walking on ground.

Breeding. Season Apr-Aug. Solitary. Territory 15-30 km² in optimum areas, elsewhere much larger. Large platform of sticks typically 70-110 cm wide and up to 100 cm deep, with central cup lined with fresh green sprigs or grass; placed in tree inside forest, 5-20 m above ground, few hundred metres from forest edge; often used in successive years, although

many pairs have 2-3 nests used alternately. Usually 2 eggs (1-3); incubation period not exactly known, probably c. 6 weeks; chicks have pure white to greyish or grey-brown down; due to cannibalism, second chick rarely survives; fledging 63-67 days (late Jul). Breeding success c. 0-6 young raised per breeding attempt.

Movements. Migratory; leaves breeding areas later than *A. pomarina* in Oct/Nov, and does not move so far south, wintering in S Europe, Middle East, NE Africa and S Asia. During migration, much less frequent at concentration points than *A. pomarina*. Arrives on breeding grounds in spring earlier than *A. pomarina*. Recently found wintering S to Sumatra.

Status and Conservation. Not globally threatened. CITES II. Total world population certainly only some few thousand birds, but populations very little studied. Formerly bred in Finland, Hungary, Romania and Israel. Now very rare in C & E Ukraine, where formerly common; decline due to deforestation, especially of river valleys. Has disappeared from many areas in W of former range in Europe. Has declined in European part of former USSR from c. 1000 pairs in 1960's, to c. 700 pairs at present; in Byelorussia, only 10-15 pairs. Very sensitive to habitat alterations, especially drainage of wetlands.

Bibliography. Ali & Ripley (1978), Austin (1948), Bazutin (1990), Bergmanis (1989, 1994), Bokotey (1994), Brazil (1991), Brown, L.H. (1976b), Brown *et al.* (1982), Bulavin (1933), Cheng Tso-hin (1987), Clark (1988), Cramp & Simmons (1980), Dementiev & Gladkov (1951), Elchécopar & Hue (1964, 1978), Flint *et al.* (1984), Forsman (1991), Galushin (1962, 1980), Gensbol (1986), Glotov (1959), Goodman *et al.* (1989), Gorban (1994), Greve (1910), Grote (1933, 1939), Haas (1956), Handrinos & Demetropoulos (1983), Hoffmann (1931, 1932, 1935), Holloom *et al.* (1988), Ivanovskiy (1993a, 1993b), Knystautas (1993), Kröl (1983a, 1983b), Kutshin (1959a, 1959b), Lehtonen (1942), Likhachev (1957), Mackworth-Præd & Grant (1957), Markgren & Markgren (1960), Medway & Wells (1976), Meyburg & Pielowski (1991), Meyburg, Mizera *et al.* (1994), Miller (1989), Mishchenko (1984), Moltom (1943), Nielsen & Christensen (1969), Pankin (1972), Paz (1987), Pererva (1989), Prikonsky (1958, 1960), Pukinsky (1966), Richardson (1990), Roberts (1991), Rogacheva (1992), Quednau (1930), Shirihai & Yekutieli (1991), Simeonov *et al.* (1990), Smythies (1986), Svensson (1975, 1987), Thiollay (1989c), Verheugt *et al.* (1993), Volke (1994), Wendland (1959), Zhezhirin (1969).

208. Tawny Eagle

Aquila rapax

French: Aigle ravisseur

German: Savannenadler

Spanish: Aguila Rapaz

Taxonomy. *Falco rapax* Temminck, 1828, South Africa.

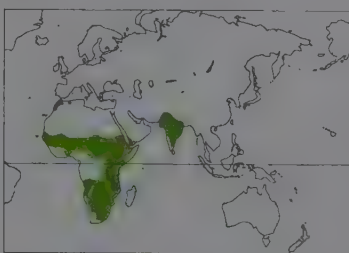
Forms superspecies with *A. nipalensis*, and sometimes considered conspecific. Race *vindhiana* has been considered separate species, but limited differences do not support this. Three subspecies normally recognized.

Subspecies and Distribution.

A. r. vindhiana Franklin, 1831 - Pakistan, India, and S Nepal; possibly also Burma.

A. r. belisarius (Levaillant, 1850) - Morocco and Algeria; S Arabia and tropical Africa S to N Zaire and N Kenya.

A. r. rapax (Temminck, 1828) - S Kenya and S Zaire S to South Africa and W to Angola and Namibia.



Descriptive notes. 65-75 cm; 1696-3100 g; wingspan 182 cm. Smaller, paler and with shallower gape than *A. nipalensis*. Individually variable in intensity of colour and extent of markings. Iris yellow amber. Female larger and usually darker and more heavily marked than male. Juvenile more plainly coloured, especially ventrally, and plumage fades to blond; often rather redder. Races differ on size, and also on markings and extent of rufous coloration, but considerable individual variation and extensive overlap; *vindhiana* smaller, generally tends to be darker, lacks tawny, and sometimes, perhaps always, has

brown iris; *belisarius* shares most plumage types with nominate race (notably very pale immature), but tends not to appear so scruffy.

Habitat. Open woodland, savanna and arid steppe; only absent from forest and true desert. In Nepal, virtually restricted to *terai*.

Food and Feeding. Mammals (to size of hare), birds (including gamebirds) and lizards form bulk of catholic diet. May also take carrion, insects, amphibia and fish when available. Dives on prey from a perch or stoops while soaring high overhead, but may also walk about collecting food on the ground. Regularly and boldly steals from other birds such as storks, other raptors and ground-hornbills (*Bucorvus*).

Breeding. Laying in dry season: Mar in NE Africa; Oct-Feb in W Africa; Mar-Oct in E Africa (peak May-Jul); Apr-Sept in S & C Africa; Nov-Mar in India. Builds a platform of sticks, lined with grass and leaves, on the crown of a thorny tree, the only African eagle to do so regularly; rarely nests on a power pylon. Often nests in vicinity of watering point for game or stock. Usually 2 eggs (1-3); incubation 39-44 days; chicks have white down; eldest chick frequently kills younger sibling; fledging 77-84 days.

Movements. Resident in most areas but perhaps some seasonal movement into more arid areas in NW and NE Africa during the rainy season; also some birds perform seasonal N-S movement in W Africa. Often mixes with flocks of migrant *A. nipalensis*. Rare vagrant to Bangladesh, NW Thailand and perhaps Sri Lanka.

Status and Conservation. Not globally threatened. CITES II. Common in many areas, including several large national parks, such as Gombe (Tanzania), Hwange (Zimbabwe) with an estimated 200 pairs, and Kruger (South Africa) with 292 pairs. Commonest eagle of Indian plains. Very

uncommon in Nepal, where presumed to be resident. Status in Burma unknown: may be mere vagrant; possibly very rare resident, e.g. along R Irrawaddy. Adaptable, breeding equally successfully at mean inter-nest spacing of 3.5–5.9 km and densities of 1 pair/64–300 km². Scavenging habits make it susceptible to poisoning and has declined in many farming areas of S and E Africa. Also declining in W and NE Africa. Not known to be affected by pesticides.

Bibliography. Ali & Ripley (1978), Benson & Benson (1975), Bergier (1987), Biggs & Biggs (1978), Boshoff *et al.* (1981), Brown, C.J. (1991), Brown, L.H. (1976b), Brown, L.H. *et al.* (1982), Clark (1992), Cramp & Simmons (1980), Dathe & Grunnt (1993), Gensbøl (1986), Ginn *et al.* (1989), Gore (1990), Grimes (1987), Handrinos & Demetropoulos (1983), Howells & Hustler (1984), Hustler & Howells (1989), Lewis & Pomeroy (1989), Mackworth-Praed & Grant (1957–1973), Maclean (1993), Osborne (1982), Paz (1987), Pickford *et al.* (1989), Pinto (1983), Roberts (1991), Smeenk (1974), Smythies (1986), Steyn (1973, 1980d, 1982), Tarboton & Allan (1984), Thiollay (1978c, 1985d).

209. Steppe Eagle

Aquila nipalensis

French: Aigle des steppes

German: Steppenadler

Spanish: Águila Esteparia

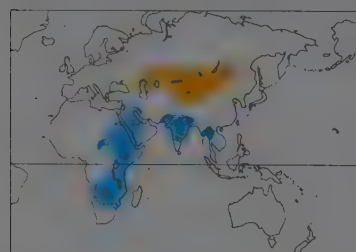
Taxonomy. *Aquila nipalensis* Hodgson, 1833, great valley of Nepal.

Often regarded as conspecific with *A. rapax*, but morphological studies have shown clear differences which should also be verified by molecular techniques. Two subspecies recognized.

Subspecies and Distribution.

A. n. orientalis Cabanis, 1854 - SE European Russia E to L. Balkhash and E Kazakhstan, or perhaps to Tien Shan and Altai; winters in Middle East, Arabia and E & S Africa.

A. n. nipalensis Hodgson, 1833 - Altai and Tibet E to Manchuria; winters in S Asia.



Descriptive notes. 72–81 cm; 2400–3900 g; wingspan 160–200 cm. Medium-sized to large *Aquila*. Separable from smaller *A. rapax* by width and length of gape. Overall dark brown, generally darker than *A. pomarina* but paler than *A. clanga*. Prominent rufous nape patch in most adults. Has oval nostrils, as opposed to round in *A. pomarina* and *A. clanga*: fleshy gape reaches far below eye; primaries banded; iris always brown. Female larger than male. Juvenile and immature almost always have characteristic broad whitish band along greater underwing-coverts; adult plumage reached by 4 years. Race *orientalis* slightly

smaller and paler.

Habitat. Steppe and semi-desert. Race *nipalensis* breeds in mountainous areas up to 2300 m; *orientalis* breeds in lowlands and low hills. Originally bred on ground in most cases, but in recent years increasingly in bushes or small trees or on artificial structures.

Food and Feeding. During breeding, race *orientalis* is most highly specialized Palearctic *Aquila*, depending on various species of suslik (*Citellus*), especially little suslik (*C. pygmaeus*), which may form up to 98.5% of its food. Also takes other small to medium-sized mammals, especially great gerbils (*Rhombomys opimus*), birds, reptiles and insects. In Transbaikalia, nominate race feeds mainly on: (54–77%) young Bobak marmots (*Marmota bobak sibirica*); and (11–37%) Daurian pikas (*Ochotona dauurica*). Much carrion eaten during migration and wintering, especially by immatures. Wintering birds in S Africa take many alate harvester termites (*Hodoterms mossambicus*) and nestling queleas (*Quelea quelea*); suspected to follow pattern of local rain showers and resultant termite flights. In E Africa, seems to eat chiefly mole rats (*Helophobius*, *Cryptomys*). Forages mainly by soaring c. 150–200 m high and diving down; also ambushes prey, by waiting at burrow entrance, and takes some prey while walking about on ground.

Breeding. Season Apr–Jul; timing of arrival in spring and start of breeding highly dependent on availability of chief prey species. Large platform of sticks typically 70–100 cm wide, but very variable in size depending on availability of nest material; nest cup often lined with smaller twigs and many other materials, e.g. old rags, bones, moulted feathers and camel dung. Usually (at least formerly) built on ground in position that allows good view of surroundings; nowadays, because of habitat alteration and persecution, often nests a few metres up on bushes, small trees, artificial structures, etc. 1–3 eggs (rarely 4, at least two cases of 5); incubation 45 days; chicks have white down after hatching, later greyish white; fledging 55–65 days. Breeding density variable, with 1 pair/7.5–53.5 km²; varies much more from year to year than in other eagles, depending upon prey availability. Breeding success also heavily dependent on food, but quite often 2–3 young fledged. Longevity of 41 years in captivity.

Movements. Race *orientalis* completely migratory, leaving breeding areas in late Aug and Sept; avoiding crossing of sea, with large concentrations observed in bottleneck areas, e.g. Israel, Suez, Bab al Mandab; winters in Middle East, Arabian Peninsula, E & S Africa. Race *nipalensis* less migratory, wintering mostly in S Asia.

Status and Conservation. Not globally threatened. CITES II. Common in suitable habitat, e.g. estimated c. 20,000 pairs in European Russia. Extirpated from large areas of former range in W; has disappeared from Romania, Moldavia and Ukraine due to habitat alteration, with conversion of steppes into fields, and persecution; also adversely affected by power lines. Trends of E populations unknown; 7852 birds recorded migrating over C Nepal in 1985. In any case, commonest eagle species of its size in the world.

Bibliography. Agafonov *et al.* (1957), Ali & Ripley (1978), Biggs & Biggs (1978), Brooke *et al.* (1972), Brown, L.H. (1976b), Cheng Tso-hin (1987), Christensen & Sorensen (1989), Clancey (1966), Clark (1992), Cramp & Simmons (1980), Davygora (1991), Dementiev & Gladkov (1951), Dobrunavov (1949), Etchécopar & Hite (1978), Fadjev (1965), Flint *et al.* (1984), Forsman (1991), Gensbøl (1986), Ginn *et al.* (1989), Goodman *et al.* (1989), Hintovt (1940), Jensen (1972), Ismagilov (1962), Ivanov (1952), Jankowitz (1976), Jensen (1972), Kharchenko & Krasovskiy (1966), Krasovskiy (1983), Korelov (1962), Kostin (1985), Lankin (1976), Lindeman (1977, 1985), Mironov (1962), Mironov (1946), Nankinov (1982), Pererva & Grazhdankin (1983), Petrov & Rozkov (1965), Pfander (1983), Postawski (1967), Richardson (1990), Roberts (1991), de Roder (1989), Rogacheva (1992), Ryabov (1969), Scapotev (1952), Semenov *et al.* (1959, 1962), Shirihai & Christie (1992), Shumner (1928), Simenon *et al.* (1990), Sludskij (1962), Smythies (1986), Survillo (1983), Suschkin (1895), Svensson (1987), Tarasov (1944), Thiollay (1989c), Treus & Strelchenko (1970), Tyurekhodzhev (1973, 1977), Varshavsky (1973), Varshavsky, Shilov *et al.* (1980), Varshavsky, Varshavsky *et al.* (1980), Vinogradov *et al.* (1977).

210. Spanish Imperial Eagle

Aquila adalberti

French: Aigle ibérique

German: Spanischer Kaiseradler

Spanish: Águila imperial ibérica

Other common names: White-shouldered/Adalbert's Eagle

Taxonomy. *Aquila adalberti* C. L. Brehm, 1861, Spain.

Often considered conspecific with *A. heliaca*; relationship only recently studied in detail by means of morphological comparison and molecular techniques; molecular data and substantial differences in morphology and ecology support full species status for present form. Forms superspecies with *A. heliaca*. Monotypic.

Distribution. C, W & S Spain; formerly more widespread, occurring in Portugal and Morocco.



Descriptive notes. c. 74–85 cm; 2500–3500 g; wingspan c. 177–220 cm. Similar to *A. heliaca*, but with very conspicuous white leading edge of wing. Immature much less streaked than that of *A. heliaca*, almost uniform tawny buff; at four years old, more mottled, with irregular pattern of pale and dark brown feathers on back, breast and belly, and some white feathers on shoulders; full adult plumage at 5–6 years.

Habitat. Persists in more forested areas of Spain, with low levels of human land use, and higher densities of rabbits. Associated with areas dominated by typical Mediterranean climates.

mate, with relatively warm, dry summers and temperate, rainy winters. Most regularly found in areas with limited amount or absence of irrigated farmlands. Rapid growth of human population in previously depopulated areas, and human presence in fields where irrigated cultures have been developed, have negative effects on distribution of species. Nests found in areas with predominant undergrowth brush of *Cistus*, *Erica*, *Phyllirea*, etc.

Food and Feeding. Total of 98 prey species recorded, of which most important is rabbit (*Oryctolagus cuniculus*), comprising 58% before myxomatosis. As consequence of myxomatosis, trophic diversity increased: in Doñana, 42% mammals, 54% birds, 3% reptiles; in Sierra Morena, 44% mammals, 41% birds, 14–6% reptiles; and in C Spain, 39% mammals, 57% birds, 3% reptiles. Most important bird species in diet are Greylag Goose (*Anser anser*), Black Coot (*Fulica atra*), Mallard (*Anas platyrhynchos*), Woodpigeon (*Columba palumbus*) and Black-billed Magpie (*Pica pica*). Prey caught mainly on ground by perch-hunting or by soaring.

Breeding. Laying from mid-Feb to end Mar. Nests only on trees, except 2 pairs on electric tower structures; prefers dominating trees, mainly cork oaks (*Quercus suber*) and pines, away from human disturbance. Large structure of sticks; nest cup lined with green twigs. Each pair has 2–6 nests. Density one pair per 52 km². Average 2.6–2.7 eggs (1–4); incubation c. 44 days; chicks have white down; fledging c. 75 days. Young birds leave natal area at 116–162 days old. Almost 10% of pairs breed in subadult plumage. Hatching success 2.4 (1–4); breeding success 1.3 per active nest, and 1.7–1.8 per successful nest; lower in mountains in N of range, higher further S. Sibling aggression reduces number of chicks during first half of nesting period; breeding success can be artificially increased, if sibicide reduced by removal and transfer of doomed chicks.

Movements. Adults sedentary. Young birds, when they become independent, leave natal areas, dispersing in all directions and travelling up to 350 km, especially to NW Africa.

Status and Conservation. ENDANGERED. CITES I. One of rarest of all birds of prey. Total population down to c. 150 pairs. Extinct in Morocco, Portugal and many parts of Spain, and now restricted to C, W & S Spain: 32% of breeding pairs in mountains of Toledo and Extremadura. Of all pairs, 22% occur in protected areas, mostly in three, El Pardo, Monfragüe and Doñana, which total only 1050 km²; protection of at least 50% highly desirable. Four areas, 15,000–40,000 ha each, with high densities of pairs and well preserved habitat remain unprotected; these areas require protection. At beginning of present century, range extended over most of Iberian Peninsula and N Morocco; drastically reduced over last 80 years. Problems include: electrocution, single most important mortality factor, causing death of up to 80% of young birds in their first year; unintentional trapping of birds in rabbit traps; poisoning; decrease of rabbit populations; and habitat alterations. In captivity, 20 birds distributed between 2 centres in Spain; no breeding success yet. Major conservation programme in progress.

Bibliography. Alonso *et al.* (1987), Brehm (1861), Brown, L.H. (1976b), Calderón, Castroviejo *et al.* (1987, 1988), Calderón, González *et al.* (1984), Collar & Andrew (1988), Delibes (1978), Ferrer (1990, 1992, 1993a, 1993b), Ferrer & Calderón (1990), Ferrer & Hiraldo (1991), Frazao (1984), Garzón *et al.* (1984), González, L.M. (1990, 1991a, 1991b), González & Grande (1991), González & Hiraldo (1988), González, Alonso *et al.* (1985), González, Bustamante & Heredia (1990), González, González *et al.* (1987), González, Heredia *et al.* (1989), González, Hiraldo *et al.* (1989a, 1989b), Heredia *et al.* (1985), Hiraldo *et al.* (1976), King (1978/79), León-Vizcaíno & Castroviejo (1978), Leveque (1960), Meyburg (1974c, 1975, 1982, 1987, 1989a), Meyburg & Garzón (1973), Meyburg & Meyburg (1991), Negro & Hiraldo (1994), Palma (1985), Seibold *et al.* (1994), Soto-Largo & Martí (1994), Suetens & van Groenendaal (1971), Valverde (1960), Veiga *et al.* (1984), Viellard (1974).

211. Eastern Imperial Eagle

Aquila heliaca

French: Aigle impérial

German: Kaiseradler

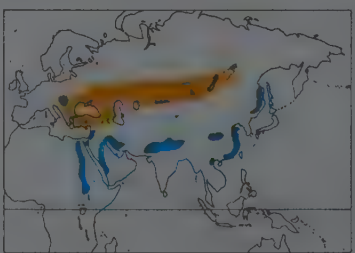
Spanish: Águila Imperial Oriental

Other common names: Imperial Eagle

Taxonomy. *Aquila heliaca* Savigny, 1809, upper Egypt.

Often considered conspecific with *A. adalberti*, but recent studies indicate that they are distinct species, differing notably in morphology and ecology. Forms superspecies with *A. adalberti*. E populations have occasionally been separated in race *ricetti*. Monotypic.

Distribution. C Europe and Turkey E to Transbaikalia and Mongolia. Winters S to E Africa, Arabia, N India and E China.



Descriptive notes. 72–84 cm; 2450–4530 g; wingspan c. 180–215 cm. Generally dark brown; crown, nape, sides of head and neck have pale tawny buff lanceolate feathers producing a pale patch. White shoulder patch, or *plumette*, much smaller than in *A. adalberti*. Immature starts pale brown with variable dark streaking, and blackish light-feathers, passes through darker, very patchy plumages over several years, before attaining adult plumage after 5–6 years.

Habitat. Originally bred on old isolated trees in plains of C & SE Europe, but has subsequently retreated to large forests in moun-

tains, as result of persecution and habitat alteration. In Slovakia and Hungary, where now well protected, starting to reoccupy former habitats. Hunts in open, often cultivated, areas.

Food and Feeding. Small to medium-sized mammals; in most areas main prey species are susliks (*Citellus*) and hamster (*Cricetus cricetus*). Birds generally taken in small proportions: 22% in Hungary, compared to 65% *C. cricetus*; nowadays main prey in Ukraine. In N Aral region, feeds mainly on rodents, especially (70-74%) great gerbils (*Rhombomys opimus*), but also susliks (7-25%), reptiles (19-23%) and birds (7-15%). In S Urals, 27 species of vertebrates recorded, with more birds than mammals. Carrion also eaten, especially in winter and during migration. Prey caught mainly on ground by perch-hunting or by soaring.

Breeding. In Hungary, adults appear in breeding areas in late Feb or early Mar, depending on weather conditions; laying completed by late Mar or early Apr. Solitary. Large stick nest, 100-150 cm in diameter; nest cup lined with green sticks, but also other materials, e.g. grass, fur, wool; almost always nests on trees, very rarely on ground or cliffs in Kazakhstan. 2-3 eggs (1-4); incubation 43 days; chicks have white down; fledging 60-77 days. Sexual maturity before adult plumage acquired at 5-6 years; pairs with both partners in subadult plumage have successfully reared young. Longevity 21 years in captivity; record of 56 years in captivity not confirmed; another case of a bird, first held in captivity for several years, later free-living for 55 years, but equally unconfirmed. Breeding success: in Slovakia, 1-6 young per successful brood, or 0-76 young per pair per year; in Hungary 1-5 young per successful brood, but 36% of breeding attempts unsuccessful.

Movements. Mostly migratory. Birds migrate to S Turkey, Iran, Israel, Iraq, Egypt and Arabia, and to Pakistan, India, Laos and Vietnam. Leaves breeding grounds mid-Sept to mid-Oct; in Slovakia and Hungary, adults often seem to remain at or near breeding areas.

Status and Conservation. RARE. CITES I. Rapid decline in Europe since World War II; total world population now down to a few thousand pairs, possibly only c. 2000. Formerly very common in many

areas, e.g. 19 occupied eyries in 1000 km² near Sofia (Bulgaria). Now very rare or extinct in many areas of SE Europe. Only in Slovakia and Hungary is species well protected and increasing. European population now only c. 350 pairs: 30-35 in Slovakia; 36 in Hungary; 10 in Serbia; 4 in Macedonia; 0-2 in Greece; 15-20 in Bulgaria; probably few in Romania; 10-12 in Moldavia; 130-150 in European Russia; 35-40 in Ukraine; few in Turkey; 9-11 in Georgia; 40-50 in Azerbaijan; c. 10 in Armenia. Larger numbers in Asia, with perhaps c. 1200 pairs in C & W Kazakhstan; estimated total for Asian part of former USSR as low as 800-1200 pairs. Problems include: shooting, especially of young birds, in many areas, most intensively in Syria; poisoning, intended for wolves and foxes; removal of young from nest, for zoos and other raptor keepers; habitat alteration, including cutting down of old forests; decrease in suslik population, due to habitat loss; mortality through electrocution or injury caused by collisions with power lines. International working group for species has been formed, and 3 meetings held in Hungary. Conservation Action Plan in preparation.

Bibliography. Abuladze (1994b), Ali & Ripley (1978), Alonso *et al.* (1987), Beaman & Porter (1985), Bergier (1987), Borodin (1984), Bragin (1983, 1987), Brazil (1991), Brown, L.H. (1976b), Brown *et al.* (1982), Collar & Andrew (1988), Cramp & Simmons (1980), Danko (1973, 1994a, 1994b), Dementiev & Gladkov (1951), Eichécupar & Húe (1978), Flint *et al.* (1984), Génsbøl (1986), Hallman (1994), Handrinos & Demetropoulos (1983), Harasizhy, Bagyura *et al.* (1994), Irisov & Irsova (1984), Knystautas (1993), Korelov (1962), Kustov (1981), Leverkus (1907), Lobachev (1960, 1961, 1967), Mackworth-Praed & Grant (1957), Meyburg, Harasizhy *et al.* (1994), Meyer de Schauensee (1984), Mitchev & Petrov (1979), Mrlik & Pavelka (1994), Nikitina (1991), Pancheshnikova (1983), Patrikeev (1990), Paz (1987), Pererva (1984), Petrov *et al.* (1994), Richardson (1990), Roberts (1991), Rogacheva (1992), Ryabtsev (1989), Seibold *et al.* (1994), Shinhai & Chrisbe (1992), Simeonov & Petrov (1980), Simeonov *et al.* (1990), Sládek (1959d), Solomonin (1970, 1974), Sonin & Lipin (1980), Svehtik & Meyburg (1979), Tapfer (1973), Telpov & Bitanov (1986), Ushkov (1949), Varshavsky (1973, 1983), Vaxvári (1939), Vetrov (1991a, 1991b), Voloshin (1949), Zahamy (1968).



212. Wahlberg's Eagle

Aquila wahlbergi

French: Aigle de Wahlberg

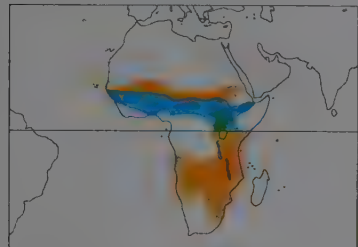
German: Silberadler

Spanish: Aguila de Wahlberg

Taxonomy. *Aquila wahlbergi* Sundevall, 1851, Mohapvani, Botswana.

May be associated with genus *Hieraaetus*, and has on occasion even been transferred to it, on grounds mainly of behaviour. Monotypic.

Distribution. Mauritania E to Ethiopia and S to South Africa.



Descriptive notes. 55-60 cm; 437-1400 g; wingspan 141 cm. Smallest member of genus *Aquila*. Polymorphic: dark brown morph most numerous (can be even darker than illustrated); paler morphs individually variable, with plain cream form most common; various intermediate morphs exist, some looking rather patchy. Slight crest, dark brown eye and small size distinctive. Juvenile indistinguishable from adult.

Habitat. Woodland and tree savanna, avoiding desert and dense forest.

Food and Feeding. Feeds mainly on reptiles, especially lizards, birds, including gamebirds,

and small mammals up to size of hare; also some insects. Hunts from perch or by stooping from soaring flight. Attacks with speed and agility, taking most prey on ground but some in aerial pursuit.

Breeding. Laying suspected Jul-Aug in W Africa; Sept-Oct in NE Africa; Aug-Nov in E Africa; Sept-Oct in S Africa; all in wet season. Builds a small stick platform in the upper open fork of a tall tree, often along a watercourse, on a hillside or on the edge of woodland. Same or adjacent site reused over many seasons. Single egg (rarely 2); incubation 44-46 days; chicks have dark brown or blond down depending on morph; elder chick kills younger sibling when present; fledging 70-75 days. Known to have lived almost 12 years.

Movements. A regular trans-equatorial, intra-African migrant, usually laying its eggs (or eggs) within a month of arriving in E, C and S Africa and departing within a month of fledging a chick. Bulk of population breeds S of equator, moving S through Uganda and Rwanda in Jul-Sept, N through Zambia and Kenya in Feb-Mar, to winter NE of equator. Relatively few breeding records in W and NE African savannas; probably a separate sub-population with limited seasonal movements, S into Guinea savannas in dry season and N to breed in Jul-Sept. A few apparently resident around equator.

Status and Conservation. Not globally threatened. CITES II. The commonest eagle in S and C Africa; generally less common in W Africa. In Transvaal (South Africa), attains mean inter-nest spacing of 2.8 km, and nesting densities of up to 1 pair/4.3 km², with estimated total of 9000 pairs. Vulnerable to clearing of woodland; not known to be affected by pesticides, but accidental poisoning may result in local population declines.

Bibliography. Auburn (1988, 1991), Benson & Benson (1975), Brown, L.H. (1952, 1953, 1955, 1976b), Brown *et al.* (1982), Gargett (1968), Gaugris *et al.* (1981), Ginn *et al.* (1989), Gore (1990), Grimes (1987), Kemp & Mendelsohn (1975), Lees (1968), Lewis & Pomeroy (1989), Mackworth-Przed & Grant (1957-1973), Maclean (1993), Pickford *et al.* (1989), Pinto (1983), Simmons (1991b, 1991c, 1992, 1993a, 1993b), Steyn (1962, 1980c, 1982), Tarboton (1977b, 1986), Tarboton & Allan (1984), Thiollay (1975a, 1975d, 1977a, 1977b, 1978b, 1978c, 1985d), Tuer (1973).

213. Gurney's Eagle

Aquila gurneyi

French: Aigle de Gurney

German: Molukkenadler

Spanish: Aguila Moluqueña

Taxonomy. *Aquila* (? *Heteropus*) *gurneyi* G. R. Gray, 1860, Batjan (Bacan) Island, Moluccas.

Sometimes transferred to genus *Spizaetus* on account of wing and tail proportions, but clearly an *Aquila* on plumage. Has been associated with possible *A. chrysaetos* superspecies. Monotypic.

Distribution. New Guinea, W Papuan Is and Aru Is; also Moluccas, where recorded on Morotai, Halmahera, Ternate, Bacan and Ambon, and recently on Seram.



Descriptive notes. 66-79.5 cm; female 3060 g. Medium sized *Aquila*, with slightly shorter wings and longer tail than congeners. Distinguished from *A. audax* by yellow feet, rounded (or only slightly wedge-shaped) tail and lack of rufous in plumage. Female larger than male. Juvenile shows shades of grey and brown, paler on underparts; distinction from juvenile *A. audax* as for adults.

Habitat. Lowland and hill primary rain forest and swamp forest, including littoral zone; forest edge and adjacent grassland; visits near-by clearings and cultivation. From sea-level up to 2970 m.

Food and Feeding. Little known. Reportedly mammals, such as cuscus (*Phalanger*); one record of eating cuscus on ground. Forages by low, slow quartering of forest canopy or ground, sometimes using ridge lift to soar along face of cliffs or hillsides.

Breeding. No information available.

Movements. Unknown, but breeding adults presumably sedentary. Occasional visitor to islands in Torres Strait, but extralimital records may represent incomplete knowledge of species' normal distribution, rather than movements.

Status and Conservation. Not globally threatened. CITES II. Apparently presents low population density; seldom encountered by ornithologists; biology unknown. Possibly threatened by deforestation in lowlands.

Bibliography. Amadon (1978), Beehler *et al.* (1986), Bowler & Taylor (1989), Brown, L.H. (1976b), Coates (1985), Diamond (1985), Garnett (1987), Jollie (1957), Mackay (1988), Melville (1980), Osborne & Osborne (1991), Rand & Gilliard (1967), Smith, G. (1992), White & Bruce (1986).

214. Golden Eagle

Aquila chrysaetos

French: Aigle royal

German: Steinadler

Spanish: Aguila Real

Taxonomy. *Falco Chrysaetos* Linnaeus, 1758, Sweden.

Has been considered to form superspecies with *A. audax*, and perhaps also with *A. gurneyi*. Race *kamtschatica* often included in *canadensis*. Six subspecies normally recognized.

Subspecies and Distribution.

A. c. homeyeri Severtsov, 1888 - Iberian Peninsula, NW Africa and large Mediterranean islands E through Egypt, Asia Minor and Arabia to Caucasus and Iran.

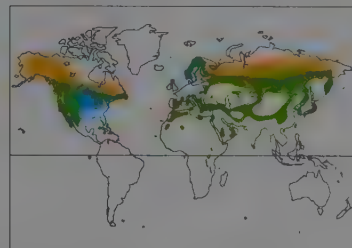
A. c. chrysaetos (Linnaeus, 1758) - NW & C Europe E to W & C Siberia and Altai.

A. c. daphanea Severtsov, 1888 - Turkestan E to Manchuria, and S to Pakistan, Himalayas and SW China.

A. c. japonica Severtsov, 1888 - Korea and Japan.

A. c. kamtschatica Severtsov, 1888 - W & C Siberia and Altai E to Kamchatka.

A. c. canadensis (Linnaeus, 1758) - North America, from Alaska S to Durango (WC Mexico), and E to Labrador, Quebec and New York.



Descriptive notes. 75-90 cm; male 2840-4550 g, female 3630-6665 g; wingspan 190-227 cm. Fairly uniform dark brown throughout crown, nape and median upperwing-coverts normally pale yellowish tawny. Female larger. Juvenile darker chocolate brown, with characteristic white bases to flight-feathers; tail basally white, with dark terminal band; white areas of plumage progressively replaced with brown over 4-5 years, although full adult plumage not until 6-8 years. Races vary slightly in size and coloration, particularly in darkness of plumage and extent and shade of pale areas; crown and nape, at least rear portion,

always clearly paler, ranging from yellowish to rufous brown.

Habitat. Open, deserted terrain, e.g. mountains, plateaux and steppe; locally marshy areas; prefers low or sparse vegetation to wooded areas. From desert areas to edge of tundra, and from sea-level up to considerable altitudes, occasionally over 2000 m in Alps and Pyrenees; may occur over 5500 m in Himalaya, roughly up to summer snow-line. For nesting normally requires remote, peaceful sites, e.g. rock faces, large trees; perches on vantage points on rocks or trees.

Food and Feeding. Prefers medium-sized mammals, mainly rodents, rabbits and hares; also, normally to lesser degree, birds, particularly gamebirds, including large grouse; much less frequently reptiles, e.g. lizards, snakes; also carrion, especially in winter. Hares, rabbits, ground squirrels (*Spermophilus*, *Citellus*) or, in mountainous areas, marmots tend to be most numerous mammal prey; domestic stock (e.g. sheep) and wild ungulates (e.g. deer) may be important in diet as carrion, whereas young and vulnerable animals are sometimes hunted; carnivores (mustelids, foxes, cats, etc.) are sometimes taken regularly. Birds range in size from small passerines up to cranes, storks or swans, but species prefers grouse and partridges. Normally captures prey on ground, using low hunting flight. Sometimes pairs hunt together. In some areas captures tortoises, dropping them onto rocks to break shells.

Breeding. Laying starts Feb in S Europe and S North America, until May in more N regions. Nests on ledges of cliffs and crags, or in trees, tendency varying regionally. Eyries traditional; normally several per pair, which are used alternately. Large nest of sticks and branches lined with greenery, up to 200 cm wide and deep. Normally 2 eggs (1-3), laid at interval of c. 3 days; incubation c. 41-45 days per egg, almost exclusively by female; hatching asynchronous; chicks have first and second down white or whitish; younger chick often dies due to older sibling's attacks; fledging 65-80 days; young can be dependent on adults and fed by them for some months, and sometimes tolerated in adults' home range until following season. 1-3 chicks fledge, normally 1, very rarely 3; one case of bigamy with 4 chicks raised; mean 0.4-1.3 per breeding pair, and 1.0-1.6 per successful pair, but wide range. Failure or non-breeding are common, sometimes occurring in 50% or more of pairs; success influenced by food supply and weather; sometimes declines if reaches very high densities. Possibly only 25% of chicks reach maturity, due to starvation, accidents with powerlines, shooting, etc. Birds live up to 38 years in wild, and up to 50 years in captivity.

Movements. Generally sedentary; mainly migratory in northernmost parts of range, both in North America and in Asia, where in winter prey may be scarce or inaccessible, e.g. hibernating ground squirrels. In North America, migrants leave breeding grounds from Sept; most winter in W USA, but S to Mexico, some in areas with resident populations too; return starts Feb, and lasts months, with juveniles returning latest. Sedentary adult pairs normally stay in approximately same home range throughout year. Juveniles markedly more dispersive and travel further.

Status and Conservation. Not globally threatened. CITES II. Heavily persecuted in past, with declines in range and numbers in Europe and much of North America, often from 19th century, and mainly due to direct persecution and poisoned baits (see page 92). Banning of poisons and protection have permitted increase or at least stabilization in many countries, but recolonization has not yet reached all of original range, e.g. still very localized in C Europe and E USA. In Europe at end of 1980's, total population c. 4500-5000 pairs; main populations in Spain with 1192-1265 pairs, and Scotland with 425 pairs; sizeable populations (of 100 to 100's of pairs) in Norway, Sweden, Finland, France, Italy, Switzerland, Austria, Greece, former Yugoslavia, Bulgaria and European Russia. At least 100 pairs in Morocco and in Turkey; 21 pairs in Israel in 1984. Little information about status in Asia; in Japan no more than 370-500 birds in 1980's. Various estimates of North American population, possibly with maximum of 70,000 birds in 1980's, with highest densities in in Wyoming, Colorado and Montana. Throughout much of range, historical causes of decline have diminished by late 20th century; limiting factors now are food supply and

On following pages: 215. Wedge-tailed Eagle (*Aquila audax*); 216. Verreaux's Eagle (*Aquila verreauxii*); 217. Bonelli's Eagle (*Hieraaetus fasciatus*); 218. African Hawk-eagle (*Hieraaetus spilogaster*); 219. Booted Eagle (*Hieraaetus pennatus*); 220. Little Eagle (*Hieraaetus morphnoides*); 221. Ayres's Hawk-eagle (*Hieraaetus ayresii*); 222. Rufous-bellied Eagle (*Hieraaetus kienerii*); 223. Martial Eagle (*Polemaetus bellicosus*); 224. Black-and-white Hawk-eagle (*Spizastur melanoleucus*); 225. Long-crested Eagle (*Lophaelus occipitalis*).

conservation of favourable habitat. Large numbers die due to accidents with powerlines, but not apparently a significant factor.

Bibliography. Ali & Ripley (1978), Amadon (1982a), Anon (1987), Armstrong (1983), Arnold (1954), Arroyo *et al.* (1990b), Bergier (1987), Bernis (1974a, 1974b), Bockel & Ray (1971), Bortolotti (1984), Brazil (1991), Brown, L.H. (1976b), Brown & Watson (1964), Brown *et al.* (1982), Calderón *et al.* (1977), Camenzind (1969), Cheylan (1973), Clouet (1981), Clouet & Goar (1981, 1984), Collopy (1980, 1982), Cramp & Simmons (1980), Delibes, Amores & Calderón (1975), Delibes, Calderón & Hiraldo (1975), Dementiev & Gladkov (1951), Dendaletche (1988), Dennis *et al.* (1984), Dixon (1937), Ellis (1979), Etchécopar & Húe (1978), Fasse & Fasse (1984), Fernández (1988, 1991), Ferrero *et al.* (1986), Fovoli & Craighead (1958), Flint *et al.* (1984), Friedmann (1950), Génsbel (1986), Goodman *et al.* (1989), Gordon (1955), Grubac (1988), Haller (1982), Handrinos & Demetropoulos (1983), Höglström & Wiss (1992), Johnsgard (1990), Jollie (1947), Jordano (1981), Knight (1927), Knutsen *et al.* (1988), Knyshtaus (1993), Kochert (1972), Kröl (1983), Lefranc & Clark (1983), Lunde (1985), Marchant *et al.* (1990), Marquiss *et al.* (1985), Martin, B.P. (1992), Marzocchi (1991), McGahan (1968), Mitchell & Millsap (1990), Murphy (1974), Olendorf (1975), Palmer (1988), Paz (1987), Polo *et al.* (1992), Richardson (1990), Roberts (1991), Rogacheva (1992), Root (1988), Scott, T.A. (1985), Simionov *et al.* (1990), Snow (1973b), Snyder & Snyder (1991), Snyder & Wiley (1976), Su Hua-long (1988), Sulkava *et al.* (1984), Tjemberg (1981, 1983, 1985), Urios (1986), Walker (1987), Watson (1992a), Watson & Langslow (1989), Watson, Leitch & Broad (1992), Watson, Leitch & Rae (1993), Watson, Payne & Rae (1989), Watson, Rae & Stillman (1992), Zastrov (1946).

215. Wedge-tailed Eagle

Aquila audax

French: Aigle d'Australie

German: Keilschwanzadler

Spanish: Aguila Audaz

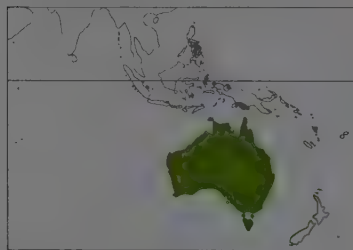
Taxonomy. *Vultur audax* Latham, 1801, New South Wales.

Formerly placed in monospecific genus *Uroaetus*, but clearly related to other *Aquila*. Has been considered to form superspecies with *A. chrysaetos*, and possibly also with *A. gurneyi*. Two subspecies recognized.

Subspecies and Distribution.

A. a. audax (Latham, 1801) - Australia, S New Guinea.

A. a. fleayi Condon & Amadon, 1954 - Tasmania.



Descriptive notes. 81-104 cm; male 2025-4000 g, larger female 3180-5300 g; wingspan 186-227 cm. Large *Aquila*; tail shape unique within genus. Distinguished from *A. gurneyi* by rufous nape, tail shape and cream-coloured to pale yellowish feet. Juvenile extensively brown and gold on upperparts; distinguished from juvenile *A. gurneyi* by dark underparts and tail shape. Race *fleayi* has heavier feet and claws; adults have pale nape, and lack rufous in plumage.

Habitat. Over most terrestrial habitats, from sea-level up to 2000 m, but avoids areas of dense human population, e.g. cities, intensive

agriculture. Occupies open forest, woodland, scrub, savanna, plains and deserts, typically in rough or remote country; avoids dense rain forest. Nests in all wooded habitats distant from human activity.

Food and Feeding. Mammals, birds, reptiles and carrion. In S prefers rabbits and hares, in N young kangaroos and wallabies (*Macropus*); other mammals more rarely captured include lamb, goat kid, cat, fox, young dog and spiny echidna (*Tachyglossus*). Birds commonly include *Corvus*, cockatoos (*Cacatua*) and waterfowl, rarely up to size of crane and bustard. Reptiles commonly include dragons (Agamidae) and monitors (*Varanus*), rarely snakes. Forages by low, slow quartering, high soaring or still-hunting from perch. Seizes prey on ground or sometimes in tree canopy, after swift, stealthy glide or dive which may become short chase; rarely takes prey in flight. Occasionally removes mammals such as possums (*Trichosurus*) from tree hollows. Pairs or groups attack large prey co-operatively. Gathers at carcasses of large animals, where dominates smaller scavengers; occasionally robs other predators.

Breeding. Apr-Sept; sometimes earlier (Jan-Feb) in tropical N of range. Solitary. Large platform of sticks typically 70-90 cm wide, 30-80 cm deep, lined with green leaves; may become 180 cm wide, 300 cm deep with repeated use. Usually built in live or dead tree with commanding view, 2-73 m above ground in tallest available tree, though often near ground in remote deserts; typically on rise or hillside. Also occasionally on cliff ledges, or among rocks, and even on ground on islands, in areas inaccessible to humans. Usually 2 eggs (1-3), rarely 4; usually 1 in Tasmania. Incubation 42-48 days in wild (slightly less in captivity); chicks have white down; fledging 79-95 days; post-fledging dependence of up to 6 months. Sexual maturity at 3 years; will pair in immature plumage though seldom breeds before adult plumage at 6 years. Oldest ringed bird 9 years; longevity 40 years in captivity. Success varies regionally: in SW Australia, 0.7-1.2 young fledged per clutch laid, 0.19-0.46 young per pair per year; in SE Australia, 0.9-1.5 young per clutch laid, 0.6-1.0 young per pair per year; in Tasmania, 0.8 young per clutch laid, 1.07 per successful nest.

Movements. Breeding adults sedentary, except in arid zone when forced to move by severe drought. Juveniles dispersive, commonly wandering off 200 km and up to 800 km, but some remain, or return to nest area; movement often follows ridges or valleys.

Status and Conservation. Not globally threatened. CITES II. Widespread and common on Australian mainland, despite formerly intense persecution for supposed impact on domestic stock (now shown to be negligible). Local declines in S through habitat disturbance in heavily settled and farmed areas, because intolerance to human activity leads to nest abandonment; has benefited elsewhere from thinning of tree cover, introduction of rabbit and provision of abundant carrion. Eggshell thickness not significantly reduced by DDT; still subject to illegal shooting and poisoning. Isolated Tasmanian race endangered, because range and population small (60-80 breeding pairs) and has more specific habitat requirements; less tolerant of habitat alteration around nest-site.

Bibliography. Bockel (1984b), Beecher *et al.* (1956), Brooker (1974, 1983), Brooker & Ridpath (1980), Brown, L.H. (1976b), Coates (1985), Copper & Copper (1981), Eddy (1959), Flay (1952), Garnett (1992), Hollands (1984), Hughes & Hughes (1984), Hull (1986), Leopold & Wolfe (1970), Marchant & Higgins (1993), Meredith (1990a, 1990b), Morris (1976b), Olsen & Marples (1992, 1993), Olsen, Crome & Olsen (1993), Pizey (1958), Price-Jones (1983), Ridpath & Brooker (1986a, 1986b, 1987), Robertson, G. (1987), Schodde & Tidemann (1988), Young, H. (1973).

216. Verreaux's Eagle

Aquila verreauxii

French: Aigle de Verreaux

German: Kaffernadler

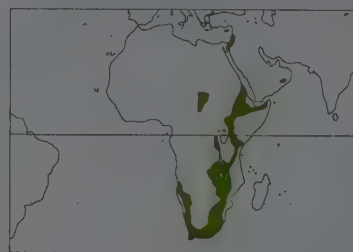
Spanish: Aguila Caffre

Other common names: (African) Black Eagle

Taxonomy. *Aquila Verreauxii* Lesson, 1830, Cape of Good Hope, South Africa.

Monotypic.

Distribution. S Chad and W Sudan; from Israel, Egypt (Sinai) and SE Arabian Peninsula; Ethiopia to Somalia and thence S, with main range Kenya S to South Africa.



Descriptive notes. 80-90 cm; male 3000-4150 g, female 3100-5800 g; wingspan 199 cm. White back and white patches in primaries notable against black plumage in flight, together with narrow black to wing. Juvenile mixed rufous, brown and black; larger and less streaked than *A. rapax*.

Habitat. River gorges and rocky outcrops, kopjes, hills and mountains, from sea-level to over 5000 m, wherever hyrax prey occurs.

Food and Feeding. In most areas, hyraxes (*Procavia*, *Heterohyrax*) form at least 90% of diet, supplemented with various medium-sized mammals, birds and reptiles; rarely

small livestock. Hunts mainly on the wing, stooping from a height or swooping rapidly around a hillside to surprise prey. Less often strikes from a perch, and only rarely pirates other raptors or comes to carrion. Pairs often hunt in tandem.

Breeding. Laying in Jan in Arabia; Oct-Dec in NE Africa; Feb-Sept in E Africa (peak Jun-Jul); Apr-Aug in S and C Africa (peak May-Jul). Builds a massive nest of sticks, lined with sprays of green leaves, on a cliff ledge, rarely in a hillside tree or on a radio tower. Usually 2 eggs (1-3); incubation 43-46 days; chicks have white down; elder chick almost invariably kills younger sibling soon after hatching; fledging 90-98 days.

Movements. Resident throughout its range, although some movement between patches of hilly habitat must occur.

Status and Conservation. Not globally threatened. CITES II. Common in suitable habitat, especially in S Africa where reported mean inter-nest densities of 9 km in Natal, 7-13 km in Transvaal and 4 km in Zimbabwe and Cape Province. Estimated 240 pairs breeding in Transvaal, South Africa. More local and uncommon in C and E Africa; sparse on Arabian Peninsula; in Israel, 2 single birds recorded in 1993. Rugged terrain often last to be modified, but species declines where drought, overgrazing and hunting combine to reduce hyrax prey. Persecuted heavily in some areas of small-stock farming, and eliminated from parts of S Africa. Not known to be affected by pesticides. The most studied eagle in Africa.

Bibliography. Allan (1988a), Benson & Benson (1975), Boshoff & Palmer (1988), Boshoff *et al.* (1991), Brown, C.J. (1988a), Brown, C.J. & Cooper (1987), Brown, L.H. (1952, 1953, 1974c, 1976b), Brown, L.H. *et al.* (1978, 1982), Cramp & Simmons (1980), Eichacker (1990), Gargett (1971, 1972, 1975, 1978a, 1978b, 1984, 1990), Gargett & Gargett (1993), Génsbel (1986), Ginn *et al.* (1989), Goodman *et al.* (1989), Jenkins (1984), Lewis & Pomeroy (1989), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Marx & van Staden (1989), Paz (1987), Pickford *et al.* (1989), Pinto (1983), Rowe (1947), Siegfried (1968), Steyn (1982), Tarboton & Allan (1984).

Genus *HIERAAETUS* Kaup, 1844

217. Bonelli's Eagle

Hieraaetus fasciatus

French: Aigle de Bonelli

German: Habichtsadler

Spanish: Aguila-azor Perdicera

Taxonomy. *Aquila fasciata* Vieillot, 1822, Fontainebleau, France, and Sardinia.

Forms superspecies with *H. spilogaster*, with which has often been considered conspecific. Race *renschii* may constitute separate species. Two subspecies normally recognized.

Subspecies and Distribution.

H. f. fasciatus (Vieillot, 1822) - NW Africa and Iberian Peninsula E through Mediterranean, SW Asia and Arabia to Afghanistan, Pakistan and India, and on through N Indochina to S China.

H. f. renschii Stresemann, 1932 - Sumbawa, Timor, Wetar, Luang and probably Flores (Lesser Sunda Is).



wing and tail feathers.

Habitat. Mainly warm, sunny mountainous or broken terrain, normally with crags and cliffs. Vegetation cover variable: normally zones with extensive growth of bushes and shrubs, e.g. maquis, garrigue; sometimes with forest, but also barren slopes with virtually no vegetation. Sometimes visits flatish open areas, with pastures, cultivation or wetlands (mostly juveniles, or outside breeding season). Generally rather retiring, although relatively adaptable to fairly humanized zones. Mainly at low or medium altitudes, but occurs up to 2000 m and above in NW Africa and Asia.

Food and Feeding. Normally medium-sized birds and mammals; adaptable, eating most readily available prey. Diet well known in SW Europe: prefers rabbits and partridges; if these are scarce, will switch to other, normally secondary, prey, e.g. pigeons, corvids, gulls, squirrels and other rodents, or lizards. In Israel takes mainly partridges and pigeons, with few mammals or reptiles. Large prey unusual, although Houbara Bustards (*Chamaeydotis undulata*), storks, herons, buzzards and foxes reported. Very agile flight, capturing most of prey on ground, but also birds in flight; sometimes pairs hunt together.

Breeding. Laying mainly from Feb to mid-Mar in Mediterranean region; Dec throughout much of Indian Subcontinent. Nests on cliff ledges, or less often in trees, habit varying with region. Nest bulky, up to 200 cm wide, 100 cm deep; built of sticks and lined with green leaves. Normally various nests per pair, often close together and even on same cliff face; used alternately. 1-2 eggs, rarely 3, laid at intervals of 2-3 days; incubation 37-41 days, mainly by female; chicks brooded and fed by female; at first only male brings prey to nest; chicks have first and second down white; fledging c. 60-70 days; juveniles may stay in territory several months more. 1-2 chicks fledge; averages in Mediterranean 1-1.5 chicks per clutch, 1-4-1.6 per successful breeding attempt. Sexual maturity possible before adult plumage acquired, very occasionally in second year. High juvenile mortality, sometimes of over 50% in first year. Recorded up to 20 years old in captivity.

Movements. Sedentary and dispersive. Breeding pairs closely tied to home range, although somewhat less outside breeding season. Juveniles disperse once independent; in SW Europe, at least, tend to move to areas not occupied by adults, often agricultural zones, with fairly gentle relief, especially rich in prey; may travel hundreds of kilometres from natal areas.

Status and Conservation. Not globally threatened, CITES II. In decline in Europe, with some regional stabilization, but in 1980's, in Spain, home to bulk of European population, perhaps up to 116 pairs disappeared; this contrasts with stability or recovery of Spanish populations of other eagles, especially *Aquila chrysaetos* and *A. adalberti*, which presumably face similar difficulties and threats; in areas of high density of *A. chrysaetos*, present species suffers somewhat, as a result of competition. Trends unknown in Africa and Asia. In early 1990's, c. 900 pairs in Europe: 679-755 in Spain, c. 75-90 in Portugal, 29 in France, c. 15 in Italy, 50-70 in Greece, and less than 60 in rest of Balkans. Estimates in N Africa of 500-1000 pairs in Morocco, perhaps 200 pairs in Algeria, and c. 100 pairs in Tunisia. In Turkey c. 50 pairs; in Israel, after slight recovery, 19 pairs in 1980's. Almost extinct in former USSR: widely distributed but rare or uncommon in Indian Subcontinent. Race *renschii* very poorly known and rarely recorded. Causes of decline not wholly understood, but species obviously affected by direct persecution and accidents with powerlines, which cause much mortality, particularly amongst juveniles; also important are degradation and transformation of habitat, reduction in numbers of prey species, and a large increase in human interference and disturbance in breeding areas.

Bibliography. Ali & Ripley (1978), Amadon (1982a), Arroyo (1991), Arroyo, Bueno & Pérez-Mellado (1976), Arroyo, Ferreira & Garza (1990c), Bergier (1987), Bergier & Naurois (1985), Blondel *et al.* (1969), Brown *et al.* (1982), Buhot (1983, 1989), Cano & Parrinder (1961), Cheylan (1972, 1973, 1977, 1978, 1979, 1980, 1981), Cheylan & Simeon (1984), Clouet & Goar (1984), Cramp & Simmons (1980), Dementiev & Gladkov (1951), Etchécopar & Húe (1978), Ferrero *et al.* (1986), Flint *et al.* (1984), Génsbol (1986), Glutz von Blotzheim *et al.* (1971), Goodman *et al.* (1989), Handrinos & Demetropoulos (1983), Heim de Balsac (1926), Hustler & Howells (1988), Insausti (1986), Jordano (1981), del Junco (1984), King (1978/79), Lebraud (1984), Leshem (1976), Mackworth-Præd & Grant (1962), Massa (1976), Morvan & Dobchies (1987), Palma *et al.* (1984), Parellada (1984), Paz (1987), Perennou (1989), Pérez-Mellado *et al.* (1977), Real (1983, 1987, 1991), Real & Mañosa (1992), Richardson (1990), Rivoire & Húe (1949), Roberts (1991), Rocamora (1994a), Salvo (1989), Simeon & Wilhelm (1988), Simeonov *et al.* (1990), Smythies (1986), Steyn (1975, 1982), Suetens (1989), Suetens & van Groenendael (1969), Thiollay (1967, 1976, 1978d), Urios (1986), Vaucher (1971).

218. African Hawk-eagle

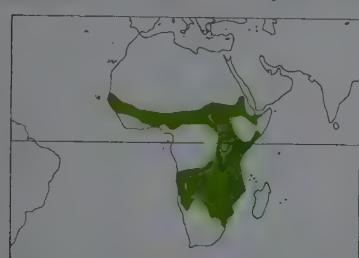
Hieraaetus spilogaster

French: Aigle fascié **German:** Afrikanischer Habichtsadler **Spanish:** Aguila-azor Africana
Other common names: African Eagle

Taxonomy. *Spizaetus spilogaster* Bonaparte, 1850, Ethiopia.

Forms superspecies with *H. fasciatus*, and sometimes considered conspecific. Monotypic.

Distribution. Senegambia E to Ethiopia and Somalia, and S to NE South Africa.



Descriptive notes. 60-70 cm; male 1150-1300 g, female 1444-1750 g; wingspan 142 cm. Distinctive pale area in primaries in flight. Recalls *H. ayresii*, but larger, usually not as heavily marked, and without pure white patch at base of forewing. Female larger and more heavily streaked below than male. Juvenile with variable amount of streaking on underparts.

Habitat. Woodland and tree savanna, extending along riverine trees, or using exotic plantations in drier habitats.

Food and Feeding. Mainly takes francolins, guinea fowl and other birds, augmented by

small mammals, such as hares and mongooses, and some reptiles. A dashing hunter, stooping from soaring flight or a perch, less often making fast prospecting flights among trees. Members of pair often hunt together and follow prey into dense vegetation. Spends long periods perched within cover or soaring high above territory.

Breeding. Laying mainly in dry season: Feb in Gambia; Jan in Somalia; Oct-Nov in NE Zaire, Uganda and W Kenya; Apr-Sept in S and C Africa (peak Jun). Builds a substantial stick nest in a prominent upper fork of a large tree, often along a watercourse, rarely on a power pylon. Usually 2 eggs (1-3); incubation 42-44 days; chicks have first down dark grey with white belly and legs, second down white; elder chick usually kills younger sibling within few days of hatching; fledging 61-71 days.

Movements. Resident and sedentary with no movements reported.

Status and Conservation. Not globally threatened, CITES II. Widespread and common through most woodland and tree savanna areas of E, C and S Africa at densities of 1 pair/30-110 km², with estimated 200 pairs in Hwange National Park, Zimbabwe, and 1600 pairs in Transvaal, South Africa. Less common in Sahel and Guinea savanna of W Africa, and steppes of SW Africa. Vulnerable to cutting of woodland, and persecuted in many areas for attacks on poultry. Not known to be affected by pesticides.

Bibliography. Allan (1988b), Benson & Benson (1975), Brown, L.H. (1952, 1953, 1955, 1976b), Brown *et al.* (1982), Ginn *et al.* (1989), Gore (1990), Grimes (1987), Howells & Hustler (1984), Hustler & Howells (1988c), Lewis & Pomerooy (1989), Maclean (1993), Pickford *et al.* (1989), Pinto (1983), Smeenk (1974), Steyn (1975b, 1982), Tarboton & Allan (1984), Tuer (1973).

219. Booted Eagle

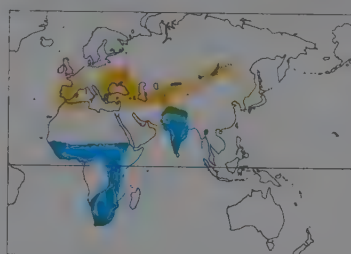
Hieraaetus pennatus

French: Aigle botté **German:** Zwergadler **Spanish:** Aguililla Calzada

Taxonomy. *Falco pennatus* Gmelin, 1788, no locality = France.

Birds of C Asia sometimes classified as race *milvoides*, or alternatively *harterti*, but variation very slight and clinal. Monotypic.

Distribution. SW Europe and NW Africa through E Europe, Asia Minor and Caucasus to C Asia, NE to Mongolia and L Baikal area, and SE to N India; also Cape Province (S South Africa), and perhaps Namibia. Winters mostly in Africa S of Sahara, and in S Asia, especially India.



Descriptive notes. 45-55 cm; male 709 g, female 975 g; wingspan 110-132 cm. Two distinct colour morphs, with several intermediate plumages; both have broad pale band across upperwing, and pale uppertail-coverts. More frequent pale morph shows whitish underparts and underwing-coverts, contrasting markedly with flight-feathers, which are very dark, apart from paler, slightly translucent innermost primaries. Dark morph rather similar to *A. wahlbergi* and *Milvus migrans*. Juvenile also polymorphic, and very similar to adult, especially in dark morph; pale morph with more streaking and reddish brown tint below. Cline

in size from W to E, with larger birds in E.

Habitat. Forests and woods mixed with open areas, often in open woodland. Type of wood varies, including broad-leaved, coniferous, mixed woods and olive and palm groves in Morocco. Flat land, low hills and mountain slopes; up to 3000 m in India, 2700 m in N Africa, and 2000 m in Bulgaria. In Cape Province (South Africa) occurs in mountainous terrain, with cliffs, low bushes and karoo scrub.

Food and Feeding. Small and medium-sized birds, from small passerines to pigeons, gamebirds and corvids; also mammals, including mice, susliks, squirrels, pikas, rabbits; reptiles, e.g. ocellated lizard (*Lacerta lepida*) important in Spain, *Agama caucasia* in parts of Pakistan; some insects, such as locusts and termite alates in S Africa. Hunts in open or wooded areas; captures prey mainly on ground, stooping from air or after spotting prey from vantage perch; sometimes pair may hunt together.

Breeding. Lays Apr-May in N of range; second half of Sept in Cape Province. Nests in trees in woods, or sometimes solitary trees; in various regions, particularly Africa, also (or exclusively) on ledges, in clefts and on small trees on cliff faces. Nest large, of sticks and twigs, lined with fresh leaves; often reused. Normally 2 eggs (1-3), laid at interval of 2-3 days; incubation 37-40 days, by female; male brings all food during incubation and beginning of fledging period; chicks have first and second down white, grey or brown (uncertain if corresponds to subsequent colour morph of individual); fledging 50-54 days; juveniles may stay with adults for another 47+ days. 1-2 chicks fledge, average c. 1.5 chicks per pair.

Movements. Mainly migratory; very scarce in winter in parts of S Europe, N Africa and Middle East; resident populations in N Pakistan and India and Balearic Is. Bulk of W population winters in sub-Saharan Africa, crossing via Gibraltar and Suez, with E populations moving to Indian Subcontinent. Leaves Eurasian breeding grounds in Sept, and returns in Mar-Apr. Breeding population of Cape Province (South Africa) moves N to NW Cape and Namibia, leaving in Mar and returning in Aug.

Status and Conservation. Not globally threatened, CITES II. Population sizes not well known, and only fairly approximate estimates available; little information on trends, although apparently stable in general. In 1980's: perhaps 3000 pairs in Spain; c. 130-150 pairs in Portugal; minimum of 500 pairs in France; c. 50 pairs in Bulgaria; 4-5 pairs in Hungary; perhaps over 200 pairs in Greece; and c. 50 pairs in Yugoslavia. In 1990's: c. 10 pairs in Poland; perhaps 600 pairs in European sector of former USSR, with c. 300 pairs in Russia, and c. 80-100 pairs in Azerbaijan; possibly c. 100-500 pairs in Turkey. In Africa, in 1980's, estimated c. 500-1000 pairs in Morocco; common in Algeria and Tunisia; over 100 pairs estimated in South Africa. Numbers on post-breeding migration over Gibraltar estimated at 10,000-19,000 birds, corresponding to French and Iberian populations; autumn maximum in Suez of 12,000 birds, which would refer to populations of SE & E Europe, Asia Minor and Caucasus. Some negative factors affecting species are habitat degradation, decline in prey species, and human persecution; declining in Ukraine due to deforestation.

Bibliography. Ali & Ripley (1978), Bergier (1987), Brooke *et al.* (1980), Brown, L.H. (1976b), Brown *et al.* (1982), Carlon (1984), Chancellor (1991), Cheng Tso-hin (1987), Clark, W.S. (1987), Cramp & Simmons (1980), Dementiev & Gladkov (1951), Donnelly (1966), Efimenko (1989), Etchécopar & Húe (1978), Flint *et al.* (1984), Génsbol (1986), Ginn *et al.* (1989), Goodman *et al.* (1989), Handrinos & Demetropoulos (1983), Holmeren (1984), Iribarren & Rodríguez Arbeloa (1988), Knystautas (1993), Król (1983), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Medway & Wells (1976), van der Merwe (1992), Paz (1987), Pickford *et al.* (1989), Richardson (1990), Roberts (1991), Rogacheva (1992), Shirihai & Christie (1992), Simeonov *et al.* (1990), Smythies (1986), Steyn & Grobler (1981), Suetens & van Groenendael (1969), Thiollay (1989c), Tribarren (1975).

220. Little Eagle

Hieraaetus morphnoides

French: Aigle nain **German:** Kaninchenadler **Spanish:** Aguililla Australiana

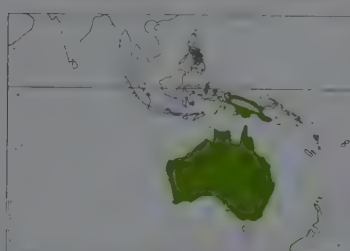
Taxonomy. *Aquila morphnoides* Gould, 1841, Hunter River, New South Wales.

Genus sometimes merged with *Aquila*, but kept separate by most modern authorities. Two subspecies recognized.

Subspecies and Distribution.

H. m. weiskei (Reichenow, 1900) - New Guinea.

H. m. morphnoides (Gould, 1841) - Australia.



Descriptive notes. Nominate race: 45-55 cm; male 530-810 g, larger female 745-1250 g; wingspan 110-136 cm. Race *weiskei* smaller: 38-48 cm; male 483 g. Small, polymorphic *Hieraaetus*: pale morph has characteristic underwing pattern, with markedly contrasted white greater coverts; dark morph generally duskier, with brown underparts and underwing, but rather variable, ranging from sandy to smoky chestnut on underparts; distinguished from closely similar *H. pennatus* by underwing pattern (pale morph), lack of white patch near shoulder, and pale cere and feet. Juveniles of both morphs more rufous. Race

weiskei shows more streaking on breast.

Habitat. Open forest, woodland, scrub and savanna, from sea-level to 1500 m in Australia, to 1950 m in New Guinea. Typically in rough, hilly country; avoids treeless areas and dense forest in Australia, but occurs over rain forest in New Guinea. Nests in forest and woodland, often riparian *Estuaries and mangroves*.

Food and Feeding. Mammals, birds, reptiles, occasionally large insects and carrion; rarely fish (possibly stolen from *Haliastur*). In S prefers young rabbits, in N birds. Takes mammals of up to 1500 g; birds commonly include parrots and passerines, rarely up to 1000 g (ducks, *Corvus*); reptiles commonly dragons (Agamidae) and large skinks, rarely snakes. Forages by quartering and high soaring; uses low flights between perches, or still-hunting from perch. Seizes prey on ground by glide or dive, sometimes by rapid stoop to tree canopy; rarely takes prey in flight.

Breeding. Season varies with latitude; longer in tropical N, occupying dry season, Mar-Sept; shorter in S, usually Aug-Oct, but rarely starting May, or extending to Dec for replacement clutches. Solitary, but sometimes near raptors of other species, though not *Aquila*. Platform of sticks 60-75 cm wide, c. 30 cm deep, lined with green leaves; placed 5-45 m above ground in fork of living tree. Usually 2 eggs (1-3); incubation c. 36-41 days; chicks have white down; fledging c. 54-66 days; post-fledging dependence c. 2 months. Sexual maturity apparently at 2 years or older. Oldest ringed bird 26 years. Success varies regionally and according to weather, being lower in very wet or drought years; in SE Australia, 0.5-1.0 young per pair per year, 0.8-0.9 young per clutch laid, and 1-1 young per successful nest.

Movements. Resident and partly migratory populations. Some breeding adults sedentary; at high latitudes and altitudes in SE of range, some birds, particularly females, spend winter in coastal or lowland areas, where they defend non-breeding territories. Juveniles dispersive. Vagrant to Halmahera (N Moluccas).

Status and Conservation. Not globally threatened. CITES II. Common and widespread in Australia; has benefited from thinning of tree cover and introduction of rabbit; has increased in range and numbers in coastal SE Australia. Eggshell thickness not significantly reduced by DDT; not easily disturbed at nest; seldom persecuted. Possibly affected locally, to minor degree, by extensive habitat clearance or by excessive loss of trees.

Bibliography. Baker-Gabb (1984b, 1985d), Beecher *et al.* (1986), Bollen (1989, 1991a), Brown, L.H. (1976b), Calaby (1951), Coates (1985), Cupper & Cupper (1981), Debus (1983b, 1984a, 1984b, 1989, 1990, 1991d), Garstone (1986), Hollands (1984), King (1990), Mallinson *et al.* (1990), Marchant & Higgins (1993), Meadrell (1990), Newgrain *et al.* (1993a), Olsen & Marples (1992, 1993), Olsen & Olsen (1987a), Olsen, Crome & Olsen (1993), Schodde & Tidemann (1988).

221. Ayres's Hawk-eagle

Hieraaetus ayresii

French: Aigle d'Ayres

German: Fleckenadler

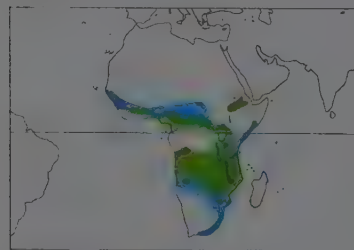
Spanish: Aguila-azor de Ayres

Other common names: Ayres's Eagle

Taxonomy. *Spizaetus ayresii* Gurney, 1862, Natal, South Africa.

May form superspecies with *H. pennatus*, and possibly even *H. morphnoides*. Until recently, frequently called *H. dubius*, but this name apparently refers to *H. pennatus*. Monotypic.

Distribution. Sierra Leone E to Ethiopia and Somalia, then S to N Namibia, N Botswana and NE South Africa.



(Sierra Leone).

Food and Feeding. Mainly birds of 40-200 g, especially doves and pigeons; also a few mammals, such as squirrels or fruit bats. Hunts mostly by fast stoop from high soaring flight, wings held in typical heart-shaped conformation, dashing through the canopy in pursuit and taking most prey in flight. Sits unobtrusively for long periods and may strike from a perch.

Breeding. Laying Nov in NE Zaire, and Feb in SE Zaire; Mar, May-Sept in Kenya; Apr-May in C Africa. Builds a large stick nest lined with green leaves, in a high fork of a large tree. Single egg; incubation 43-45 days; chick has white down with dark grey spot in front of eye; fledging 73-75 days.

Movements. In the rainy season (Nov-Apr) moves out of denser and taller deciduous woodlands of C Africa into more open tree savanna further S, and probably into coastal E Africa; spring foliage turns woodland into forest and tree savanna into woodland. May then enter towns in S Africa to prey mainly on doves and feral pigeons. Similar N-S movements expected in W Africa, where species recorded (uncertainly) W to Senegambia.

Status and Conservation. Not globally threatened. CITES II. Generally considered rare and sparsely distributed; apparently only reasonably common in woodlands of C Africa. Vulnerable to clearing of woodland. Not known to be affected by pesticides but persecuted in parts of S non-breeding range for preying on racing pigeons. Naturally low breeding success reported from E Africa, but unstudied elsewhere.

Bibliography. Benson & Benson (1975), Brown, L.H. (1952, 1953, 1955, 1966, 1974b, 1976b), Brown & Davey (1978), Brown *et al.* (1982), Dewhurst *et al.* (1988), Ginn *et al.* (1989), Grimes (1987), Hartley (1982), Lendrum (1982), Lewis & Pomeroy (1989), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Pickford *et al.* (1989), Pinto (1983), Snow (1978), Steyn (1982), Tarboton & Allan (1984), Wolf (1984).

222. Rufous-bellied Eagle

Hieraaetus kienerii

French: Aigle à ventre roux

German: Rothbauchadler

Spanish: Aguila-azor Ventrirroja

Other common names: Chestnut-bellied/Rufous-bellied Hawk-eagle

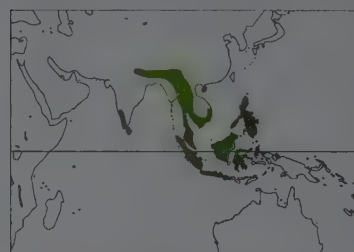
Taxonomy. *Asur kienerii* Geoffroy Saint-Hilaire, 1835, Himalayas.

Two subspecies recognized.

Subspecies and Distribution.

H. k. kienerii (Geoffroy Saint-Hilaire, 1835) - NE India and Nepal; SW India (W Ghats) and Sri Lanka.

H. k. formosus Stresemann, 1924 - Burma and Hainan through W. S. & EC Indochina and Malay Peninsula to Greater Sundas, Bali, Philippines and Sulawesi.



Descriptive notes. 42-60 cm; male 732 g; wingspan 90-127 cm. Small, dark, aerial eagle with short bushy crest. Bright rufous underparts and underwing-coverts only noticeable at close range, appearing dark greyish from afar. Wing shape and underwing pattern in flight similar to those found in buzzards. Juvenile strikingly different, with completely white underparts and underwing. Race *formosus* smaller, with darker upperparts.

Habitat. Heavy evergreen and moist deciduous forest from foothills up to 1500 m, and perhaps higher.

Food and Feeding. Feeds on birds and mammals, e.g. squirrels; some rather large birds taken, including pheasants, junglefowl and pigeons. Very aerial hunter; captures prey on or near ground or treetops after spectacular stoops, reminiscent of Peregrine Falcon (*Falco peregrinus*).

Breeding. Season: Dec-Mar in Sri Lanka and S India; Feb in Philippines; somewhat later in N India. Large nest built by pair in crown of large tree in dense forest; lined with green leaves. Display flight involves repeated dives with wings closed, and also shivering of wings. 1 egg; incubation by both sexes. Pair vigorous in defence of nest against humans. No further information available.

Movements. Mainly sedentary, but migrants reported on Malay Peninsula. Status on Bali uncertain, possibly only uncommon migrant or vagrant; recently seen on Flores; also recorded on Ternate (N Moluccas).

Status and Conservation. Not globally threatened. CITES II. Widespread, but status variable: rare in Java and Burma; scarce in Nepal; uncommon in Philippines; moderately common in Sulawesi. During recent raptor survey in Java only rarely recorded, invariably in forest fragments. Recently found to be common in forested areas of NE India and SW India (W Ghats). Has undoubtedly suffered as result of extensive deforestation that still continues throughout most of range.

Bibliography. Ali & Ripley (1978), Bishop *et al.* (1994), Brown, L.H. (1976b), Cheng Tso-hin (1987), Clark & Schmitt (1993), Deignan (1945), Dickinson *et al.* (1991), Henry (1971), Inskipp & Inskipp (1985), King *et al.* (1975), Lekagul & Round (1991), MacKinnon (1988), van Marle & Voous (1988), Medway & Wells (1976), Meyer de Schauensee (1984), Smythies (1981, 1986), Stresemann (1940a), Thiollay & Meyburg (1988), White & Bruce (1986).

Genus POLEMAETUS Heine, 1890

223. Martial Eagle

Polemaetus bellicosus

French: Aigle martial

German: Kampfadler

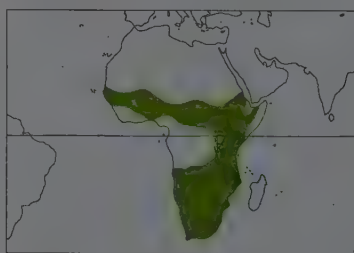
Spanish: Aguila Marcial

Other common names: Martial Hawk-eagle

Taxonomy. *Falco bellicosus* Daudin, 1800, Great Namaqualand, South Africa.

Monotypic genus, but may be better placed in genus *Hieraaetus*, on grounds of strong skeletal evidence. Monotypic.

Distribution. Senegambia E to Ethiopia and S to South Africa.



Descriptive notes. 78-86 cm; 3012-6200 g; wingspan 212 cm. Large head and long broad blackish wings notable. Resembles *Circus pectoralis*, but larger, with black spots on lower breast and dark underwing. Grey and white juvenile resembles that of *Stephanoaetus coronatus*, but for short tail, long wings and pure white underparts.

Habitat. Any areas of open habitat from desert and steppe to grassland and woodland.

Food and Feeding. Mainly vertebrates weighing 1-5 kg, with large birds (e.g. gamebirds and waterfowl), monitor lizards, or mammals (e.g. hares, hyraxes, mongooses and

small antelopes) predominating as prey in different habitats. Takes some small livestock and poultry. Hunts for long periods on the wing, soaring high overhead in search of prey and striking after a long shallow dive, sometimes concealed behind cover. May also strike from a prominent perch.

Breeding. Laying mainly in dry season: Nov in W Africa; Aug-Jan in NE Africa; Feb-Nov in E. C and S Africa (peak Apr-Jun). Builds a large structure of sticks in a main fork of an emergent tree, or even on a power pylon, cliff or boulder in open areas. Nest often visible from far off, and well lined with green leaves when active. Single egg (rarely 2); incubation 47-51 days; chick has down dark grey above and white below; fledging 96-99 days; may remain dependent on parents for 8-12 months after fledging. Usually breeds annually in some areas (South Africa), biennially in others (Zimbabwe).

Movements. No regular movements reported, but juveniles range widely.

Status and Conservation. Not globally threatened. CITES II. Widespread and common in E and S Africa, less so in W Africa. Occupies many types of savanna and steppe, but occurs at low densities with home ranges of 108-302 km². Estimated 110 pairs for Hwange National Park (Zimbabwe), and 100-120 for Kruger National Park and 500 pairs for whole of Transvaal (South Africa). Occurs in many large national parks, reserves and extensive ranching areas, spreading range into treeless areas by use of power pylons. Heavily persecuted in some small-stock and free-range poultry farming areas, and extirpated from parts of South Africa, Namibia and Zimbabwe. Breeding in immature plumage might indicate population decline, e.g. in Transvaal. Not known to be affected by pesticides.

Bibliography. Allan (1988b), Benson & Benson (1975), Boshoff (1993), Boshoff & Palmer (1980), Boshoff & Vernon (1980a), Boshoff *et al.* (1990), Brown, C.J. (1991b), Brown, L.H. (1952, 1953, 1955, 1966, 1976b), Brown, L.H. *et al.* (1982), Ginn *et al.* (1989), Gore (1990), Grimes (1987), Howells & Huxler (1984), Huxler & Howells (1987), Kemp & Kemp (1974), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Marx & van Staden (1989).

Pickford *et al.* (1989), Pinto (1983), Smeenk (1974), Steyn (1980a, 1982), Tarboton (1976), Tarboton & Allan (1984), Thiollay (1978c).

Genus *SPIZASTUR* G. R. Gray, 1841

224. Black-and-white Hawk-eagle

Spizastur melanoleucus

French: Aigle noir et blanc **German:** Elsteradler **Spanish:** Aguila-azor Blanquinegra

Taxonomy. *Buteo melanoleucus* Vieillot, 1816, Guiana.

Monotypic genus, very similar to Old World *Hieraetus*. Monotypic.

Distribution. E & S Mexico (Veracruz, Oaxaca) through Central America to Colombia, whence S on Pacific slope to W Ecuador, and E through N Venezuela to the Guianas, then S through E & S Brazil to NE Argentina and Paraguay; E Peru (Loreto) and N & E Bolivia (Beni to Santa Cruz).

Descriptive notes. 51-61 cm; 850 g. Head, neck and underparts, including underwing-coverts, immaculate white; crown and short, bushy occipital crest black; above black; tail brownish with narrow white tip and four black bands. Iris pale orangish yellow, cere orange, feet bright yellow. Differs from immature *Spizaetus ornatus* in much darker upperparts and black lores. Female similar, but larger. Immature has some white edging to upperwing-coverts, and brownish grey admixture on back.

Habitat. Very catholic in habitat requirements: variety of forested areas in tropical and

subtropical zones, but seems to prefer areas with some open country or rivers. Savanna and gallery forest in Mato Grosso, SW Brazil.

Food and Feeding. Prey recorded includes mammals, reptiles, toads and many birds, e.g. caciues (*Psarocolius*), araçaris (*Pteroglossus*), tinamous and chachalacas (*Ortalis*); tanagers and cotingas attacked on fruiting trees; cormorants and (threatened) Brazilian Mergansers (*Mergus octosetaceus*) in Misiones, NE Argentina. Monkeys have not been recorded as prey, but attacks on troops of small monkeys have been witnessed. Stoops from a high soar, at c. 200 m, into forest canopy; seems to prefer forest edge and ridges for foraging, perhaps to facilitate hunting technique of soar and stoop.

Breeding. Only one nest recorded, in Panama: construction initiated in Sept, during very dry period in midst of rainy season, but abandoned when heavy rains recommenced. Male in breeding condition in Mar, Belize; dates on eggs collected in Guyana suggest laying in dry season (Mar-Apr). Stick nest 40 m high in tall tree, on ridge overlooking a mosaic of forest and open country.

Movements. No information available.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Extensive range, but spotty distribution. Rare in most areas, but relatively common at one forest site in French Guiana, with estimated average density of at least 7 individuals/10,000 ha; rare and very local in Colombia; sparsely distributed throughout Brazil. Tolerance of diverse habitat types suggests species should not be too seriously affected by transformation of habitat.

Bibliography. Amadon (1982a), Belton (1984), Blake (1977), Chebez (1989), Contreras *et al.* (1990), Hilty & Brown (1986), Howell & Webb (1992a), Meyburg (1986), Meyer de Schauensee & Phelps (1978), Monroe (1968), Ornat

et al. (1989), Ortiz (1986), de la Peña (1992), Pinto (1964), Remsen & Ridgely (1980), Ridgely & Gwynne (1989), Ruschi (1979), Russell (1964), Sick (1985a, 1993), Slud (1964), Stiles & Skutch (1989), Strauch (1975), Terborgh (1983), Terborgh & Weske (1975), Thiollay (1989a, 1989b), Wetmore (1965), Willis (1988).

Genus *LOPHAETUS* Kaup, 1847

225. Long-crested Eagle

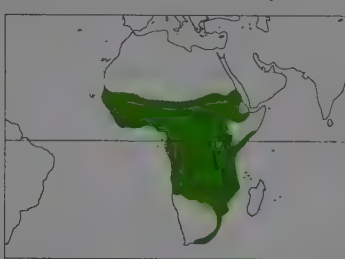
Lophaelus occipitalis

French: Aigle huppard **German:** Schopfädel **Spanish:** Aguila Crestilarga

Taxonomy. *Falco occipitalis* Daudin, 1800, Knysna district, South Africa.

Monotypic genus, but may belong within genus *Spizaetus*. Monotypic.

Distribution. Senegambia E to Ethiopia and S to N Namibia, N Botswana and E South Africa.



Descriptive notes. 53-58 cm; male 912-1363 g, female 1367-1523 g. Broad, rounded wings with white carpal patches distinctive in flight. Long crest present at all ages. Female larger than male. Juvenile similar to adult; fresh male and juvenile plumage accompanied by pure white legs, adult female often has off-white to brown legs.

Habitat. Edges of forest and woodland bordering on patches of marsh and long grass. Moves readily into exotic pine and eucalypt plantations and small-scale cultivation.

Food and Feeding. Mainly rodents and shrews, especially *Otomys* in S Africa; also

some birds, up to size of francolin, reptiles, arthropods, and rarely fish or fruit. Perches in prominent position for long periods, swooping down to take prey on the ground below. Usually swallows prey whole via its wide gape.

Breeding. Laying generally in wet season, but erratic and may breed successfully more than once in a year: Jan/Mar-Apr in W Africa; Jun-Aug in NE Africa; all months in E Africa; Apr-Jan in S and C Africa. Builds a relatively small platform of sticks in an upper fork of a tall tree on the edge of forest or woodland. 1-2 eggs; incubation 42 days; chick has first down pale grey, second down grey above and white below; fledging 53-58 days; two chicks may be raised quite regularly and sometimes a second brood.

Movements. No regular movements reported but renowned in S, E and NE Africa for turning up, and sometimes even breeding, in temporarily wet areas after good rainy seasons.

Status and Conservation. Not globally threatened. CITES II. Common, especially in E Africa, but often locally distributed where and when suitable moist habitat occurs. Estimated 200 pairs in Transvaal, South Africa. Conspicuous, but not usually persecuted, due to recognition of primarily rodent diet. Vulnerable to degradation of woodland and drainage of wetlands, but compensates to some extent by using exotic plantations, small agricultural clearings and other secondary forest habitats. Not known to be affected by pesticides.

Bibliography. Benson & Benson (1975), Brown, L.H. (1952, 1953, 1976b), Brown *et al.* (1982), Ginn *et al.* (1989), Gore (1990), Grimes (1987), Hall (1979a, 1979b, 1982, 1992), Jarvis & Crichton (1984), Lewis & Pomeroy (1989), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Pickford *et al.* (1989), Pinto (1983), Scott (1983), Snow (1978), Steyn (1978, 1982), Tarboton & Allan (1984), Thiollay (1978c).



226



227

ssp. cirrhatus



normal morph

ssp. linnaeetus



dark morph

227



ssp. floris



ssp. nipalensis

228



ssp. orientalis



229



230



231



232



233



234



235



236



237

Genus *SPIZAETUS* Vieillot, 1816

226. Cassin's Hawk-eagle

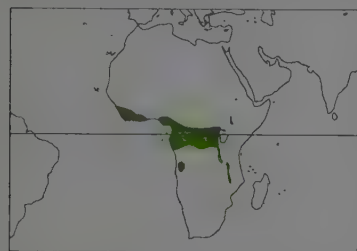
Spizaetus africanus

French: Aigle de Cassin German: Schwarzsachseladler Spanish: Aguila-azor Congoleña

Taxonomy. *Limnaetus africanus* Cassin, 1865, Ogabi River, Gabon.

The only African member of the genus (as presently defined); previously placed in *Hieraetus*, or more often in its own genus *Cassiniaetus*. Monotypic.

Distribution. Sierra Leone and Liberia E to W Uganda and E Zaire; also NW Angola.



Descriptive notes. 50-61 cm; male 938-1049 g, female 1153 g. Slight crest, short rounded wings, black underwing coverts and long tail; lightly spotted below. Most like *Hieraetus ayresii*, but plainer white below; generally whiter below than *Accipiter melanoleucus*. Female has less black on flanks. Juvenile pale rufous, with underparts spotted darker.

Habitat. Lowland tropical evergreen forest and adjacent secondary and gallery forest, even entering plantations with large trees.

Food and Feeding. Poorly known. Mainly birds, also squirrels, recorded from stomach contents. Probably hunts mostly by perch-hunt-

ing in forest canopy, or soars low over forest in search of prey, so difficult to observe.

Breeding. Laying in Oct-Dec in Ghana and Gabon; Dec in Uganda. Sometimes soars calling loudly above forest canopy. Builds large stick nest high in forest tree; used in successive seasons. Only a single chick ever recorded, with white down, still present in the nest area 6 months after fledging.

Movements. None recorded. Probably resident and sedentary.

Status and Conservation. Not globally threatened. CITES II. Recorded infrequently, but probably commoner than supposed, and large tracts of forest habitat still exist in Congo Basin. Angolan specimen suggests species may be more widespread than so far recorded. Vulnerable to deforestation, but uses many secondary habitats; numbers probably reduced in many areas of W Africa. Not known to be affected by pesticides.

Bibliography. Brosset (1971), Brown *et al.* (1982), Chapin (1932), Grimes (1987), Macdonald (1980a), Macdonald & Taylor (1977), Mackworth-Præd & Grant (1957-1973), Pinto (1983), Serle *et al.* (1977), Skorupa (1981), Snow (1978), Thiollay (1985d).

227. Changeable Hawk-eagle

Spizaetus cirrhatus

French: Aigle huppé German: Haubenadler Spanish: Aguila-azor Variable
Other common names: Crested Hawk-eagle (*cirrhatus*); Sunda Hawk-eagle (*floris*)

Taxonomy. *Falco cirrhatus* Gmelin, 1788, India.

Races *limnaetus* (incorporating *andamanensis* and *vanheurni*) and *floris* sometimes considered two separate species on grounds of plumage and lack of crest, but behaviour appears to be identical. Six subspecies normally recognized.

Subspecies and Distribution.

S. c. cirrhatus (Gmelin, 1788) - India S of Rajasthan and Gangetic Plain.

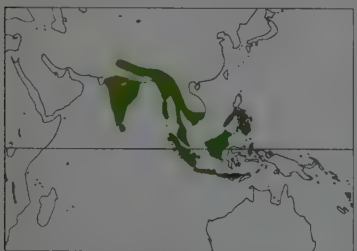
S. c. ceylanensis Gmelin, 1788 - Sri Lanka.

S. c. andamanensis Tytler, 1865 - Andaman Is.

S. c. limnaetus Horsfield, 1821 - N India and Nepal through Burma, W & S Indochina and Malay Peninsula to Greater Sundas and W & SE Philippines (Palawan, Mindoro, Mindanao).

S. c. vanheurni Junge, 1936 - Simeulue I (off W Sumatra).

S. c. floris Hartert, 1898 - mountains of Sumbawa and Flores.



Descriptive notes. 57-79 cm; 1300-1900 g; wingspan 127-138 cm. Typical hawk-eagle occurring in two forms, crested and crestless. Dark brown above, and heavily streaked dark on whitish underparts. Differs from other Asiatic *Spizaetus* in that leg feathering does not extend down between toes. Juvenile similar, but with pale head and less heavily marked underparts. Race *ceylanensis*, with long crest, similar to nominate but smaller; other races crestless, but otherwise fairly similar to nominate; *floris* all white below, virtually unmarked; *limnaetus* has dark morph, not recorded in N India.

Habitat. Deciduous and evergreen forest, as well as secondary forest and tea and teak plantations, in lowlands and foothills up to 1500 m. Mainly at forest edge and in open woodland, but usually not inside dense forest, where replaced by *S. nannus* or *S. alboniger*.

Food and Feeding. Small and large birds, snakes, frogs, lizards and mammals. Hunts like large goshawk, from concealed perch inside forest, or along forest edge. Prey captured after short rapid stoop.

Breeding. Season varies: usually Dec-Jan in Borneo, Sumatra, Sri Lanka and Malay Peninsula; mainly Jan-Feb (Nov-Apr) throughout India; Apr-Aug in Java; downy young in Oct in Sumatra. Large stick nest built by pair 10-30 m up, in crown or high fork of large tree; usually in forest, but alternatively in isolated tree. Display probably consists of pair soaring over territory, constantly calling, 1 egg; incubation by female, estimated to take over 40 days, one bird fledged after 68 days; period of dependency unknown.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES II. Widespread and apparently common to uncommon throughout extensive range; scarce in Java, due to deforestation.

Bibliography. Ali & Ripley (1978), Allen (1949), Amadon (1953, 1982a), Bishop *et al.* (1994), Brown, L.H. (1976b), Clark & Schmitt (1992), Dickinson *et al.* (1991), Henry (1971), Inskipp & Inskipp (1985), King *et al.* (1975), Lekagul & Round (1991), MacKinnon & Phillips (1993), van Marle & Voous (1988), Medway & Wells (1976), Smythies (1981), Stresemann (1938), Wilkinson *et al.* (1991a, 1991b).

Round (1991), MacKinnon (1988), van Marle & Voous (1988), Medway & Wells (1976), Naomiji (1985), Riley (1938), Schmutz, E. (1977), Smythies (1981, 1986), Thiollay & Meyburg (1988), Tikader (1988), White & Bruce (1986)

228. Mountain Hawk-eagle

Spizaetus nipalensis

French: Aigle montagnard German: Bergadler Spanish: Aguila-azor Montañesa
Other common names: Hodgson's/Feather-toed Hawk-eagle

Taxonomy. *Nisaetus Nipalensis* Hodgson, 1836, Nepal.

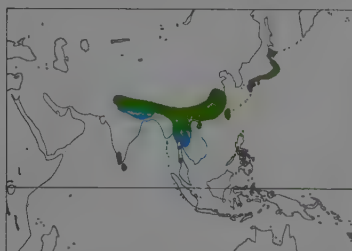
Forms superspecies with *S. alboniger*, *S. bartelsi*, *S. lanceolatus*, and *S. philippensis*. Proposed races *fokiensis* and *whiteheadi* of S China not valid. Three subspecies recognized.

Subspecies and Distribution.

S. n. orientalis Temminck & Schlegel, 1844 - Japan.

S. n. nipalensis (Hodgson, 1836) - Himalayas of India and Nepal E through S China and Hainan to E China and Taiwan, and S to N Indochina and N Malay Peninsula; recently Vietnam.

S. n. kelaarti Legge, 1878 - SW India (W Ghats) and Sri Lanka.



Descriptive notes. 67-86 cm; 1800-3500 g; wingspan 130-165 cm. Large, powerful hawk-eagle with dark and light tail banding of even width. Juvenile generally paler, and almost entirely whitish below. Japanese race *orientalis* largest, with short crest; *kelaarti* differs from nominate only in smaller size.

Habitat. Montane forest from 600 m to 4000 m.

Food and Feeding. Mostly small to medium-sized mammals, especially hares, and game birds, e.g. pheasants and quails; occasionally lizards and snakes, and even one report of a fish; will readily take domestic fowl. Typical hawk-eagle, hunting from cover inside forest and

along forest edge. Prey captured, usually on ground, after short, rapid stoop from concealed perch.

Breeding. Season usually Dec-Mar in Sri Lanka; Jan-Apr in Japan; and Feb-June in Himalayas. Large nest built by pair 12-25 m up large tree, often conifer in N India and Japan. Display flight probably consists of pair soaring over territory while calling; also undulating flight. Usually 1 egg, rarely 2 (reports of 3 from Japan require verification); incubation perhaps only by female; incubation and nestling periods unknown, but estimated to total c. 80 days; dependency period may be long, as young birds seen with parents long after nesting period. Pair vigorous in defence of nest against humans.

Movements. Mainly sedentary; however, fairly common in lowlands of Thailand in winter, and a few individuals, possibly juveniles, have been recorded in Malay Peninsula and in lowlands of Japan. Erroneously recorded on spring passage at Beidaihe (NE China), probably due to confusion with *Pernis ptilorhynchus*. Many birds claimed to move S onto Gangetic Plain.

Status and Conservation. Not globally threatened. CITES II. Uncommon to rare; has undoubtedly suffered as result of extensive deforestation that still continues throughout most of range.

Bibliography. Ali & Ripley (1978), Amadon (1953, 1982a), Brazil (1991), Brown, L.H. (1976b), Cheng Tso-hin (1987), Deignan (1945, 1963), Etchécopar & Hùe (1978), Henry (1971), Inskipp & Inskipp (1985), King *et al.* (1975), Lekagul & Round (1991), Medway & Wells (1976), Meyer de Schauensee (1984), Roberts (1991), Smythies (1986).

229. Blyth's Hawk-eagle

Spizaetus alboniger

French: Aigle de Blyth German: Traueradler Spanish: Aguila-azor Indonesia
Other common names: Mountain Hawk-eagle(!), Black-and-white Hawk-eagle(!)

Taxonomy. *Nisaetus alboniger* Blyth, 1845, Malacca, Malay Peninsula.

Forms superspecies with *S. nipalensis*, *S. bartelsi*, *S. lanceolatus* and *S. philippensis*. Monotypic.

Distribution. S Burma (Tenasserim) and S Thailand through Malay Peninsula to Sumatra and off-lying islands; N Borneo.



Descriptive notes. 52-58 cm; 830 g. Typical hawk-eagle with fairly long crest, but blacker above than most of congeners. Juvenile has brown head and pale underparts; similar to smaller, sympatric juvenile *S. nannus*; subadult of present species almost identical to adult *S. nannus*.

Habitat. Hill and montane evergreen forest from 200 to 1700 m.

Food and Feeding. Arboreal mammals, birds, lizards and sometimes bats; will take domestic fowl. Captures prey in trees after agile flight; hunts in upper storeys of forest, presumably from concealed perch in typical manner of genus.

Breeding. One nest with incubation in Nov, fledging in Feb; one nest in Sumatra, with incubating female in Jul. Large nest built by pair in crown of emergent tree in forest. Noisy aerial display over forest; possible display involves undulating flights of pair; may also include soaring. At one nest, only 1 young fledged. No further information available.

Movements. Apparently sedentary.

Status and Conservation. Not globally threatened. CITES II. Generally appears to be uncommon. Long term threat is loss of habitat, with extensive deforestation throughout much of range.

Bibliography. Amadon (1953, 1982a), Brown, L.H. (1976b), Deignan (1963), King *et al.* (1975), Lekagul & Round (1991), MacKinnon & Phillips (1993), van Marle & Voous (1988), Medway & Wells (1976), Smythies (1981), Stresemann (1938), Wilkinson *et al.* (1991a, 1991b).

230. Javan Hawk-eagle

Spizaetus bartelsi

French: Aigle de Java German: Javaadler Spanish: Aguila-azor de Java

Taxonomy. *Spizaetus nipalensis bartelsi* Stresemann, 1924, western Java. Forms superspecies with *S. nipalensis*, *S. alboniger*, *S. lanceolatus* and *S. philippensis*. Sometimes considered to be race of *S. nipalensis*, but clearly distinct. Monotypic.

Distribution. Java.



Descriptive notes. 56-61 cm. Typical hawk-eagle, with long crest. Heavily barred below, recalling considerably larger *S. nipalensis* and smaller *S. nanus*; much deeper rufous on head and neck. Juvenile has rufous buff head and underparts; underparts unmarked, as is typical for genus.

Habitat. Humid tropical forest; mainly in primary forest, but also to lesser extent in secondary forest; typically found at 200-1200 m, but recorded up to 3000 m.

Food and Feeding. Preys on large birds, including junglefowl (*Gallus*); mammals, e.g. stink badgers (*Mydaus*) and fruit bats; also li-

zards. Hunting methods not recorded.

Breeding. Season May-Aug. Nest built by pair in tall tree in forest. 1 egg. No further information available.

Movements. Apparently sedentary.

Status and Conservation. VULNERABLE. CITES II. One of rarest of all raptors. Population estimate, based on recent surveys, suggests that 52-61 pairs remain, although c. 15-20 more pairs might be found in as yet unsurveyed areas. Most of these occur in small forest reserves, which urgently require far more rigorous protection measures. Chronic loss of forest is major factor in decline of species, along with exponential growth of human population in Java. Other threats include (illegal) bird trade: species regularly seen in Jakarta bird markets; dispersing immatures are particularly vulnerable, as they tend to wander into areas with denser human population. Shooting also seems to have accounted for fair numbers.

Bibliography. Amadon (1953, 1982), Andrew (1985), van Balen (1991), van Balen & Meyburg (1994), Brown, L.H. (1976b), Collar & Andrew (1988), Kuroda (1933-1936), MacKinnon (1988), MacKinnon & Philipps (1993), Meyburg (1986), Meyburg *et al.* (1989), Thiollay & Meyburg (1988).

231. Sulawesi Hawk-eagle

Spizaetus lanceolatus

French: Aigle des Célèbes **German:** Celebesadler **Spanish:** Aguila-azor de Célebes
Other common names: Celebes Hawk-eagle

Taxonomy. *Spizaetus* [sic] *lanceolatus* Temminck and Schlegel, 1844, Sulawesi.

Forms superspecies with *S. nipalensis*, *S. alboniger*, *S. bartelsi* and *S. philippensis*. Monotypic.

Distribution. Sulawesi and off-lying islands of Muna and Butung; Banggai Is (Peleng) and Sula Is.



Descriptive notes. 56-64 cm. Boldly marked hawk-eagle, without crest. Striking similarity in plumage to that of sympatric *Pernis celebensis*. Juvenile has white head and unmarked white underparts.

Habitat. Primary and old secondary forest with open areas, from 250 to over 2000 m.

Food and Feeding. Few data available. Probably takes small to medium-sized birds and mammals, with some snakes and lizards; also said to take domestic fowl. Apparently hunts from concealed perches like congeners; preys to hunt over grassy clearings in forest.

Breeding. One nest in Aug. Nest was on large

horizontal limb of huge tree in forest; cradled in epiphytes c. 20 m above forest floor. No further information available.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Generally uncommon and local; status very poorly known. Common in Dumoga-Bone National Park (N Sulawesi).

Bibliography. Amadon (1953), Andrew (1992), van Bemmelen & Voous (1951), Bishop *et al.* (1994), Brown, L.H. (1976b), Brown & Amadon (1968), Stresemann (1940a), White & Bruce (1986).

232. Philippine Hawk-eagle

Spizaetus philippensis

French: Aigle des Philippines **German:** Philippinenadler **Spanish:** Aguila-azor Filipina

Taxonomy. *Spizaetus philippensis* Gould, 1863, Philippines.

Forms superspecies with *S. nipalensis*, *S. alboniger*, *S. bartelsi* and *S. lanceolatus*. Monotypic.

Distribution. Philippine Is.



Descriptive notes. 64-69 cm; 1168 g (1 bird). Typical hawk-eagle with long crest. Somewhat similar in plumage to smaller sympatric *Pernis celebensis*. Juvenile has pale head, as is typical for genus; also pale underparts, with some barring on belly and flanks.

Habitat. Forest in lowlands and foothills.

Food and Feeding. No information available. Presumably similar to other members of genus, taking large birds and some mammals.

Breeding. No information available.

Movements. Apparently sedentary.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-

threatened. Generally considered to be uncommon, but may be commoner than thought, with few reports because of retiring habits and dearth of ornithological research. Overall status very poorly known; fairly common at Mt Katanglad (N Mindanao).

Bibliography. Amadon (1953), Brown, L.H. (1976b), Brown & Amadon (1968), Dickinson *et al.* (1991), DuPont (1971), Ferguson-Lees & Faull (1992), Gilliard (1950), McGregor (1909-1910), Parkes (1970), Rand & Rabor (1960).

233. Wallace's Hawk-eagle

Spizaetus nanus

French: Aigle de Wallace **German:** Dschungeladler **Spanish:** Aguila-azor de Wallace
Other common names: Small Hawk-eagle

Taxonomy. *Spizaetus nanus* Wallace, 1868, Sarawak.

Long considered synonymous with *S. alboniger*, due to confusion with immature plumages of latter. Two subspecies recognized.

Subspecies and Distribution.

S. n. nanus Wallace, 1868 - S Burma (Tennasserim) and S Thailand through Malay Peninsula to Sumatra and Borneo.

S. n. stresemanni Amadon, 1953 - Nias I (off W Sumatra).



Descriptive notes. 43-58 cm; 500-610 g. Small, typical hawk-eagle with crest. Adult similar in plumage to subadult of sympatric *S. alboniger*; but present species smaller and paler, with more pale bands in tail. Juvenile likewise very similar to that of *S. alboniger*, with buffy head and underparts. Adult of race *stresemanni* as nominate, but juvenile has head and underparts white.

Food and Feeding. Prey includes birds, bats, lizards and skinks. Hunting methods not recorded, but probably similar to those of congeners.

Breeding. Only nest known contained large chick in Feb. Nest was c. 35 m up, in lowest

fork of huge tree in forest.

Movements. Apparently sedentary.

Status and Conservation. RARE. CITES II. Uncommon to rare. Increasingly threatened by loss of lowland rain forest throughout range; rarely seen, but may be commoner than hitherto suspected. Race *stresemanni* of Nias I currently reckoned to be endangered.

Bibliography. Amadon (1953, 1982a), Brown, L.H. (1976b), Brown & Amadon (1968), Collar & Andrew (1988), Deignan (1963), Humphrey & Bain (1990), King *et al.* (1975), Lekagul & Round (1991), van Marle & Voous (1988), Medway & Wells (1976), Smythies (1981, 1986), Stresemann (1938), Wells (1985).

234. Black Hawk-eagle

Spizaetus tyrannus

French: Aigle tyran **German:** Tyrannenadler **Spanish:** Aguila-azor Negra

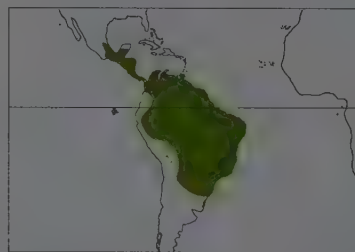
Taxonomy. *Falco tyrannus* Wied, 1820, Bahia, Brazil.

Like *S. ornatus*, not clearly related to Old World species of the genus. Two subspecies recognized.

Subspecies and Distribution.

S. t. serus Friedmann, 1950 - C Mexico S to Colombia, whence E of Andes to the Guianas, Trinidad and Brazil, and S to Paraguay and NE Argentina; recent records W of Andes in Ecuador and Peru (but not Colombia).

S. t. tyrannus (Wied, 1820) - E & S Brazil and extreme NE Argentina (Misiones).



Descriptive notes. 58-71 cm; male c. 950 g, female 1120 g; wingspan 140 cm. Glossy black overall; rather bushy occipital crest has feathers basally white; very broad wings; long, rounded tail with brownish grey tip and three broad grey bands; thighs, feathered tarsi, undertail- and underwing-coverts narrowly barred white. Iris bright orange, cere slate, feet yellow. Female similar to male, but larger. Juvenile unique in genus: has throat, forehead, supercilium and tips of crest feathers white, head mixed white and buff; browner above than adult; breast streaked brown and black, belly mottled blackish and white. Race *serus* smaller and less

heavily marked on underwing-coverts; flanks, thighs and legs with more distinct white barring.

Habitat. Tropical forests, generally in lowlands, but up to 2000 m, and even to 3000 m in Guatemala. Prefers semi-open habitat, second growth forest, forest edge or vicinity of rivers, but also occurs in extensive forests. While purportedly prefers more open forest than *S. ornatus*, occurs in dense forest both at Tikal National Park (Guatemala) and in forests N of Manaus (NC Brazil); present species recorded more frequently than *S. ornatus*, possibly reflecting a preference for more open, disturbed habitats, but perhaps related with more frequent and higher soaring.

Food and Feeding. Birds, mammals, iguanas and snakes. Mammals mostly arboreal, e.g. squirrels, small monkeys and bats, and nocturnal marsupials, which are delivered in broad daylight. In Yucatán (SE Mexico), toucans and araçaris (Ramphastidae) made up over 50% of prey items; all birds 82% of prey, rest being small to medium-sized mammals. In Belize reported to feed more heavily on small mammals. In the Petén (Guatemala), mammals made up 96% of identified prey items, with bats 31% of recorded prey items. Apparently takes most of prey by perch-hunting; regularly soars high.

Breeding. In Panama, chicks recorded in Feb, feathered young in Jul, fledglings in Aug. Stick nest c. 110 cm wide; one placed 17 m up a 23 m mahogany tree in Yucatán; in crown of royal palm (*Roystonea*) in Panama; in the Petén, nests in tall trees, supported by dense tangles of vines, rather than crotch of large branch. Fresh boughs delivered to nest during nesting period. Courtship entails display flight with contact and roll-overs; in Petén, birds quiet around nest, not vociferous as reported elsewhere. 1 egg. At one nest in Petén: hatching in May (late dry season); female abandoned nest 63 days later, leaving male to provision the young for remaining of nestling and fledgling dependency periods; fledgling 71 days. Young probably have long dependency period, permitting adults to nest only every third year, as in *S. ornatus* and other large tropical forest raptors. Normally, both parents feed the young.

Movements. Apparently sedentary.

Status and Conservation. Not globally threatened. CITES II. Fairly common in suitable habitat, but not in areas that have been heavily disturbed by agriculture. Locally fairly common in Colombia. Declining in Mexico, due to habitat loss caused by cattle ranching, the timber industry and tourism.

Bibliography. Amadon (1982a), Belton (1984), Blake (1977), Cheber (1989), Clinton-Elliott (1986), Funes *et al.* (1992), Gail & Brown (1986), *Mexico de Schmittsen & Pielou* (1978), Moine (1968), Ornat *et al.* (1989), Ortiz (1986), de la Peña (1992), Pinto (1964), Rangel-Salazar & Enriquez-Rocha (1993), Ridgely (1980), Ridgely & Gwynne (1989), Robbins & Ridgely (1990), Ruschi (1979), Russell (1964), Sick (1985a, 1993), Slud (1964), Smith

(1970), Süles & Skutch (1989), Terborgh (1983), Terborgh & Weske (1975), Thiollay (1985a, 1989a, 1989b, 1989), Wetmore (1965), Wiedenfeld *et al.* (1985).

235. Ornate Hawk-eagle

Spizaetus ornatus

French: Aigle orné

German: Prachtadler

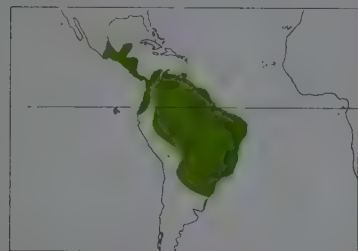
Spanish: Aguila-azor Galana

Taxonomy. *Falco ornatus* Daudin, 1800, Cayenne.

As with *S. tyrannus*, relationship to Old World species of genus unclear. Two subspecies recognized.

Subspecies and Distribution.

S. o. vicarius Friedmann, 1935 - SE Mexico through Central America to W Colombia and W Ecuador.
S. o. ornatus (Daudin, 1800) - E Colombia E to the Guianas and Trinidad, and S through E Ecuador, NE Peru, N & E Bolivia and Brazil to Paraguay and N Argentina (Jujuy to Misiones).



Descriptive notes. 58-67 cm; male c. 1000 g, female c. 1450 g. A large, powerful, strikingly coloured hawk-eagle: black crown and occipital crest set off by chestnut on sides of head and hindneck, extending to sides of breast; otherwise white below, boldly barred black below breast; tarsi feathered; above blackish; tail has three greyish brown bars. Iris orange, cere and legs yellow. Much larger than very similarly plumaged immature of *Accipiter poliogaster*. Female similar to male, but larger. Immature extensively white below, recalling adult and immature of *Spizastur melanoleucus*, but lacks black mask and has more black on

flanks and underwings; iris pale yellow; progression to adult plumage gradual, apparently taking more than one year; occipital crest becomes black, and black barring on flanks and thighs becomes more prominent. Race *vicarius* much brighter and deeper chestnut on head and neck.

Habitat. Humid forest in tropical and subtropical zones, in Colombia usually up to 1200 m, but occasionally up to 1800 m; elsewhere reported rarely up to 3000 m. Inhabits denser, more extensive tracts of primary forest than *S. tyrannus*. Sometimes near open areas in *llanos* of Venezuela; in the Petén (Guatemala), occurs in low swamp forest, as well as high primary forest. Nest trees often at forest ecotones, frequently close to base of low hills, or near area of low trees or agricultural clearings. Frequently soars over nesting territory.

Food and Feeding. A powerful raptor that mainly hunts large prey: especially birds, including macaws, parrots, toucans, pigeons, cocks-of-the-rock, cracids (*Penelope*, *Crax rubra*), tinamous, Little Blue Heron (*Egretta caerulea*) and chickens; mammals, including kinkajou, agoutis, squirrels, rats and 1 bat; occasionally reptiles, e.g. iguanids, teids, snakes; one seen feeding on American Black Vulture (*Coragyps atratus*) which it had presumably killed, at a monkey carcass. In Petén, 55% of prey items were birds, 31% mammals, and 14% unidentified vertebrates. Agoutis were an important part of the food delivered to a nest in Manaus, Brazil. One male delivered mostly squirrels to nest; females take larger prey; avian prey weighs 160-3800 g. No reports of monkeys as prey, but recorded attacking troops of small monkeys. Usually hunts from perch in middle storey, often along forest edge, but also in forest itself; moves about inconspicuously from perch to perch. Prey caught on ground or in trees; sometimes stoops on prey in canopy.

Breeding. In Petén (Guatemala), rather extended season, with laying in Jan-May (dry season); fledging at beginning of rainy season in Panama; in Manaus, NC Brazil, copulation in June, laying in Aug (peak dry season). Stick nest 100-125 cm wide, in tall tree, e.g. silk cottonwood (*Ceciba penandra*); often on large lateral branch some metres from main trunk of tree; often somewhat isolated from other tall trees, with easy access for adults to the nest but reduced access to nest for potential terrestrial predators; one pair usurped nest of *Buteogallus urubitinga*. Courtship begins a month or two before egg-laying. Flight display entails calling and diving c. 10 m with folded wings, and pitching back up from bottom of dive. 1 egg; incubation c. 48 days, almost entirely by female; fledging 66-93 days; young remain near nest, being fed by adult (usually the male), for up to 1 year after fledging. Adults can probably breed only every third year, when successful. Female aggressively defends 50 m around nest from other birds and mammals (coati, tayras). Male rarely delivers food to nest, transferring it to female c. 100 m from nest; does not feed young, but will incubate while female feeds. Female begins hunting when young c. 3 weeks old, initiating attacks from nest tree itself (one captured a coati 15 m from the nest), but hunting actively farther from nest only late in nestling period. Female ignores young after fledging, expanding home range, from c. 640 ha prior to laying, to 1970 ha after fledging, moving 5-6 km from nest; male stays closer, usually c. 1 km from nest, but expands home range to 1090 ha, when young fledged.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES II. Relatively common, although apparently outnumbered by *S. tyrannus*, where the two co-exist. Has decreased at S limit of range in Argentina, and in areas of heavy deforestation in S Brazil; very few records from W Ecuador. Average density of at least c. 13 individuals/10,000 ha estimated at one forest site in French Guiana; in Petén, density estimated at 1 nest/787 ha.

Bibliography. Amadon (1982a), Belton (1984), Blake (1977), Clinton-Eimiear *et al.* (1991), Eimiear (1988), Flatten *et al.* (1989, 1990), Hilty & Brown (1986), Inigo-Elias *et al.* (1987), Klein *et al.* (1988), Lyon & Kuhnigk (1985), Madrid *et al.* (1991), Meyer de Schauensee & Phelps (1978), Monroe (1968), Monteiro & Mattos (1984), Montenegro *et al.* (1992), de la Peña (1992), Pinto (1964), Ridgely & Gwynne (1989), Robbins & Ridgely (1990), Russell (1964), Sick (1985a, 1993), Slud (1964), Stiles & Skutch (1989), Terborgh (1983), Thiollay (1989b), Trail (1987), Vannini (1989), Wetmore (1965).

Genus STEPHANOAEETUS W. L. Sclater, 1922

236. Crowned Hawk-eagle

Stephanoaetus coronatus

French: Aigle couronné

German: Kronenadler

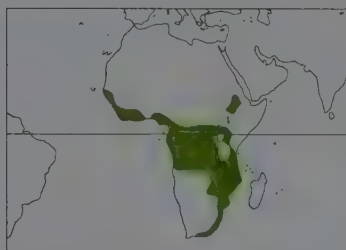
Spanish: Aguila Coronada

Other common names: (African) Crowned Eagle(!)

Taxonomy. *Falco coronatus* Linnaeus, 1766, coast of Guinea.

Monotypic genus; sometimes merged with *Spizaetus*, but skeletal anatomy recalls *Harpia*. Monotypic.

Distribution. Senegambia E to S Kenya and C Ethiopia, and S to Angola, NE Botswana and E South Africa.



Descriptive notes. 80-99 cm; male 2700-4120 g, female 3175-3853 g; wingspan of male 163 cm, female 180 cm. Long tail and short, rounded wings like a giant goshawk. Small face and voluminous crest notable at all ages. Female larger, more heavily marked below, with one less black wingbar than male. Juvenile similar grey and white to that of *Polemaetus bellicosus*, but different proportions and habitat, and rufous wash below.

Habitat. Forest and dense woodland, from extensive lowland rain forest to small patches of montane and riverine forest, and even stands of mature exotic plantations. When foraging,

moves into surrounding secondary forest or dry savanna where necessary.

Food and Feeding. Mainly mammals, especially monkeys and small antelopes in lowland rain forest, or hyraxes and viverrids in drier forests. Will also take other vertebrates such as pangolins, porcupines, squirrels, gamebirds, pigeons and large lizards; rarely small livestock or carrion. An extremely powerful eagle, dropping onto prey from a perch or stooping from soaring flight. Mates may combine in various aerial attack strategies and usually share prey. Often kills prey in excess of own body weight; large prey, up to 20 kg, is dismembered and the pieces cached in tree forks. Adults, but not juveniles with white plumage, are taunted and threatened by monkeys.

Breeding. Laying Oct-Dec in W Africa and Zaire; all months in Gabon and E Africa (peak Jun-Aug); Feb-Nov in S Africa. Each pair may have own preferred laying cycle. Performs a regular aerial display with loud calling high above territory. Builds a massive structure of sticks lined with sprays of green leaves, in the main fork of a large forest tree; often used over many years. Usually 2 eggs (1-2); incubation 49-51 days; chick has white down; elder chick always kills younger sibling within a few days of hatching; fledging 90-115 days; post-fledging dependence 90-350 days, so may only breed in alternate years in some areas.

Movements. Resident and sedentary.

Status and Conservation. Not globally threatened. CITES II. Common and widespread within extensive lowland forest habitats of W and E Africa; 1 pair/20 km on river transects; small home range of 10 km²; and nests 2.5-12 km apart. Common in other forest types, but habitat often patchy, as in Kenya, Malawi or South Africa (only 100 pairs estimated for Transvaal). Vulnerable to deforestation and overhunting of prey animals, so now rare in many parts of W Africa. Persecuted in some areas of S Africa for small-stock losses. Not known to be affected by pesticides.

Bibliography. Bataamba (1989), Benson & Benson (1975), Brosset & Erard (1986), Brown, L.H. (1952, 1953, 1955, 1966, 1971, 1972b, 1976b, 1982), Brown, L.H. *et al.* (1978, 1982), Ginn *et al.* (1989), Grimes (1987), Holdaway (1994), Jarvis *et al.* (1980), Leland & MacLachy (1937), Lewis & Pomeroy (1989), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Msuya (1993), Pickford *et al.* (1989), Pinto (1983), Steyn (1982), Struhsaker & Leakey (1990), Tarboton & Allan (1984), Thiollay (1978c, 1985d), Thomsett (1988), Tuer & Tuer (1974), Vernon (1984).

Genus OROAETUS Ridgway, 1920

237. Black-and-chestnut Eagle

Oroaetus isidori

French: Aigle d'Isidore

German: Isidoradler

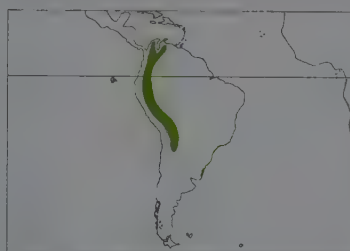
Spanish: Aguila Poma

Other common names: Isidor's Eagle

Taxonomy. *Falco Isidori* Des Murs, 1845, Santa Fé de Bogotá, Colombia.

Monotypic genus closely related to *Spizaetus*, in which sometimes included. Monotypic.

Distribution. Coastal ranges of NW Venezuela (Carabobo) and NE Colombia (Santa Marta Mts), and S on subtropical slopes of Andes from Venezuela (Mérida) through Colombia, Ecuador and Peru to WC Bolivia and (formerly?) NW Argentina.



Descriptive notes. 60-80 cm, wingspan c. 175 cm. Large, stocky eagle with relatively short tail. Head, crest, neck and upperparts black, below chestnut streaked with black; thighs black, feathered tarsi chestnut; tail greyish, with thick black subterminal band; underside of primaries whitish with black tips, contrasting sharply with chestnut secondaries and underwing-coverts. Crest seems to be erected when "relaxed"; held erect even in flight, and lowered in stressful situations. Female similar to male, but significantly larger. Iris orange-yellow, cere yellowish horn, feet yellow. Immature fuscous brown above; head, neck and

underparts white; tail with two visible blackish bands above broader subterminal band; hindneck and mantle streaked dusky, crest tipped black. Gradual transition to adult plumage, with progressive darkening over four years; underparts become streaked with chestnut and dusky brown; iris blue-grey in juvenile, becoming yellowish in older immature birds.

Habitat. Heavily forested mountain slopes in subtropical zone, probably occurring mostly in large valleys; usually at 1500-2800 m, but recorded from sea-level up to 3500 m.

Food and Feeding. Large birds (e.g. guans) and arboreal mammals, from squirrels (frequently delivered to young) to monkeys (*Lagothrix*). Powerful legs and talons specialized for taking large prey. Hunts primarily in the canopy; soars frequently and is rarely seen perched.

Breeding. Few nests found. In Venezuela, nest building Feb-Mar, hatching May, fledging probably Aug; in Bolivia, nesting in Aug. Very large stick nest, up to 2 m wide; built in emergent tree, or in tree on side of ravine; in Venezuela, prefers oaks, and perhaps east-facing valley slopes; greenery brought to nest from time to time. Probably only 1 egg; chick has white down; fledging estimated at 4 months. Male provides most of food until young well developed; noisily announces arrival at nest; will feed young if female away from nest.

Movements. Presumably sedentary.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Rare and patchily distributed; status very poorly known. Probably susceptible to loss of continuous forest habitat; observed in some partially logged tracts of forest, but perhaps as direct result of loss of extensive primary forest in subtropical zone. No records in NW Argentina since 1957.

Bibliography. Amadon (1950), Blake (1977), Eijlsd & Krabbe (1990), Hilty & Brown (1986), Lehman (1959), Meyer de Schauensee & Phelps (1978), Olog (1985), Parker *et al.* (1992), de la Peña (1992), Thiollay (1991a).

Class AVES

Order FALCONIFORMES

Suborder SAGITTARII

Family SAGITTARIIDAE (SECRETARYBIRD)



- Large raptorial birds with hooked bill, long stork-like legs, loose crest of long feathers and long central tail feathers.
- 125-150 cm.



- Afrotropical Region.
- Woodland, savanna and steppe.
- 1 genus, 1 species, 1 taxon.
- No species threatened; none extinct since 1600.

Systematics

The Secretarybird (*Sagittarius serpentarius*) has always been placed in its own monospecific family, usually in its own suborder, Sagittarii, and sometimes even elevated to the rank of its own order, Sagittariiformes. It has usually been placed adjacent to other diurnal birds of prey in the order Falconiformes and family Accipitridae, although relationships with seriernas (Cariamidae), bustards (Otididae) or cranes (Gruidae) in the order Gruiformes have also been proposed.

It has a number of distinctive anatomical features, especially in the skeleton and musculature of the skull, legs and toes, which preclude its inclusion in any other families of diurnal birds of prey. Its karyotype is also quite different from other birds of prey and certainly not like the distinct arrangement of the Accipitridae, nor is it like that of the seriernas. Superficially, the Secretarybird appears and acts like a "long-legged marching" or "pedestrian" eagle, and indeed with eagles it shares similar anatomy of the skull and head, except for the long upper eyelashes, while it also has related feather lice. However, aspects of its breeding habits are most similar to those of storks in the order Ciconiiformes and it is notable that recent anatomical interpretations, comparisons of behaviour and studies of DNA-DNA hybridization indicate a close affinity between storks and birds of prey.

The family is now confined to Africa, but fossil remains of two other species in the genus *Pelargopappus*, with a stork-like and relatively shorter tarsometatarsus, exist from the Middle and Upper Oligocene and early Miocene of France. A smaller true hawk (Accipitridae) of convergent leg morphology has also been described from the Miocene of North America.

Morphological Aspects

The Secretarybird stands about 1.2 m tall, and its most notable features are the long legs, the elongated, spatulate nape feathers and the long central tail feathers. The legs and elongated central tail feathers extend well behind the bird in flight and the neck is also extended, like a stork. When the bird is on the ground, the crest feathers form a distinctive coronet if raised or lie along the nape like a ponytail.

The head is decidedly aquiline, with its hooked blue-grey bill, the yellow cere around the elongate, vertical, oval nostrils,

the bright orange bare facial skin and the long crest. The neck is not especially long, and the bill can only reach to the intertarsal joint, which means that the bird must stoop or kneel to pick up any object from the ground or to drink. However, the gape is wide, allowing large food items to be swallowed whole, so that only very large prey or morsels for the chicks need be torn apart with the bill while being held down with the feet, in the style of an eagle, though often more clumsily.

The long legs are clothed in black feathered breeches down to the intertarsal or "knee" joint. The bare tarsus and feet are a deep pink, with heavy scaling, especially down the front, which may protect them when walking or attacking prey. Animals of whatever size are disabled by being kicked with the stout toes and short curved claws, but the feet lack any significant grasping ability. The three anterior toes are interconnected by a strong web at the base, and the inner and



The long, broad wings of the Secretarybird render it capable of efficient soaring flight, although it actually moves about most of the time on foot. Its flight silhouette is quite distinctive, with the long legs and greatly elongated central tail feathers projecting beyond the rest of the tail, the long neck, and the contrast between the gray body plumage and the black flight-feathers.

[*Sagittarius serpentarius*.
Photo: David Hosking/
FLPA]

The Secretarybird spends much of the day walking about over grassland or bare ground in search of food. Rain does not necessarily put a halt to this activity, although during particularly wet spells, when the grass is soaked, birds tend to spend more time at their roosting sites and commence their foraging activity later in the day. The length of the grass is decisive in terms of suitable feeding habitat, for birds tend to avoid areas where it grows one metre tall or more, as this prevents them from moving about comfortably and easily.

[*Sagittarius serpentarius*,
Nairobi National Park,
Kenya.
Photo: José Antonio
Martínez]



outer toes are equally developed, possibly to increase the strike area of the foot, whereas the hind toe is much smaller, probably to improve the stride.

The toes are about one fifth, and the legs about three times, the length of those of an eagle of equivalent body size. The length of the legs, aided by balance and lift from the opened wings, allows considerable speed, dexterity and manoeuvrability when attacking prey. The head is kept well clear until the prey is immobilized, whereafter the bird stoops to pick up the food in the bill. Only small or harmless prey may be picked up directly and despatched with the bill.

On average the wings span 2.12 m. They are broad and are used mainly in soaring flight, with the upturned primary feathers held well apart to provide deep slotting for control of turbulence. Flapping flight is heavy, slow, and can not be maintained for long without assistance from some form of rising air, which means that under certain conditions birds may be chased to exhaustion. However, once aloft, they are capable of performing spectacular display or attack flights with great agility and speed.

The plumage is pale grey above, offset by the white upper-tail-coverts, and white below, with the black abdomen and thighs standing out. The primary, secondary and tertial flight-feathers in the wing are also black, looking like coat-tails when folded, and in flight contrasting with the grey upperwing- and white underwing-coverts. The tail feathers are marbled at the base with black and grey, have a broad black sub-terminal band

and end in a white tip. The five outer feathers on each side are graduated in size, but the long central pair still project some 20 cm past the longest of them. The long crest feathers are black, and when folded form a dark patch down the back of the neck.

The sexes are identical, except that males probably average slightly smaller than females, and are a bluer shade of grey. They tend to have a longer tail, a shorter, more rounded head, with slightly less bare facial skin, and more crest feathers, some of which may be grey. Immature birds are similar to adults but can be distinguished by the paler orange colour of the facial skin, the black, as opposed to pale blue-grey, bill and the fine grey barring on the underwing- and undertail-coverts. The eye is dark brown in young chicks, pale grey in juveniles and subsequently hazel brown in adults. Juveniles fledge in either grey or grey-brown plumage, and young females probably have the grey areas of the flight-feathers and coverts tipped with brown.

Habitat

It is only the areas of forest and dense woodland within sub-Saharan Africa that are not utilized by Secretarybirds. They occur in all types of grassland and savanna, from the driest steppes bordering the Namib and Sahara Deserts to the high moist grasslands of South Africa and Ethiopia. They are most

common in areas of short open grassland with scattered low thorn trees, especially in eastern and southern Africa, habitats which also support the abundance of arthropods and other small animals that form the bulk of their diet. However, food supplies fluctuate in many parts of their range during alternating periods of drought and rainfall, making them nomadic over much of their range, but resulting in their abundance in a variety of habitats over time.

Secretarybirds generally avoid patches of dense bushes and trees, due to the problem of taking off in such confined places. However, if pressed, they can take to the air in a single bound, rather than running the few initial steps as they prefer, and they can use this technique to clear the livestock fences that now span their habitat in many areas. They also avoid hilly and rocky areas, or areas of dense, tangled grass, over which they have trouble walking with their long stilt-like legs.

Within their home range they require at least one tree with a flat and robust canopy, on top of which they can roost and build their nest, although they will occasionally roost and breed on the ground. Normally, they prefer a low thorny *Acacia* tree, and the flat tops of many African species provide ideal platforms, but when necessary their choice may range from a low bush to the top of a tall introduced pine or indigenous forest tree, at heights of 1.8-36 m. Ideally, their territory will include several suitable trees that can provide alternate roost- and nest-sites. Although one site may be used for many years, the large nests tend to tilt or collapse into the crown with time, and in most cases a new nest-site is used each year, where feasible.

General Habits

Secretarybirds are usually encountered in pairs, the birds walking some distance apart across the savanna and hunting independently for any prey they may find or flush. They do not seem to wander independently through their territory, except when one bird is confined to the nest, and part of their daily movements may involve patrolling the area against neighbours and other intruders.

Single birds are mostly found in less suitable areas and apparently are usually adult males, occupying territories until conditions improve sufficiently for them to attract potential mates to the area. Young birds of both sexes also roam widely before maturity and often turn up in areas unoccupied by resident adults, such as fields within woodland or around airports. In such unfamiliar and marginal habitat they seem more prone to accidents, including predation or collisions with wires and vehicles; on top of this, they are regularly evicted from occupied areas by resident adults. Rarely, as many as 50 birds may gather in an area with special resources, for instance during plagues of locusts or rodents, around a pool of water in more arid environments, or where insects are flushed before a bush

fire. It is not known if these concentrations comprise breeding residents or non-breeding nomads.

Pairs may spend an hour or more at their roosts after first light, preening and warming in the sun, or descend to do the same on the ground nearby. Hunting then starts in earnest and may continue for much of the rest of the day, during which a distance of up to 20 km may be walked, the head nodding to and fro with each step. Occasional breaks are taken to preen, rest in the shade or squat down on the "knees". Sometimes birds even lie down, to sleep, to dust-bathe or to stretch out in the sun with the wings wide open. Where available, they may even seek out water to bathe or drink.

Secretarybirds usually take off and land with considerable grace, running a few paces with the wings outstretched when not airborne, but they can also run, jump and leap into the air with great agility. They often take to the wing in the middle of the day, to take advantage of thermals to cool off or soar from one area to another, rising as high as 3800 m over their territory. Soaring may also stimulate neighbours to take off, besides giving a good overview of the area, and encounters with intruders often lead to territorial disputes, involving either aerial pendulum displays (see Breeding) or pursuits that end on the ground with several birds involved in energetic bouts of leaping, kicking, running and chasing. Such encounters may be mistaken for courtship dances and are also shown as play behaviour between recently fledged chicks.

In the late afternoon, pairs make their way back to the roost area and fly up onto the roost tree at dusk. They sleep crouched down on the canopy or on an old nest, usually with the head tucked back under the wing.

A territory may extend over 20 km² in mixed tree and grass savanna, 45 km² on dry grassland, or 70 km² on montane grassland within South Africa. Densities of 50 km²/pair have been reported for parts of the Transvaal and Zimbabwe, but densities may be as low as 100-500 km²/pair during years of low rainfall or in more arid areas of the continent.

Voice

Secretarybirds are generally silent, except when aggressively proclaiming their presence. The main call is a deep guttural croak that becomes a loud roaring groan at high intensity, sometimes uttered with the head thrown back. It is uttered in flight during pendulum displays, on the ground during fights and at the nest by mates during bowing greeting displays, or by large chicks in response to a predator.

A single high croak indicates alarm, while deeper croaks are used in threat. Softer clucking calls and low whistles are also given by mates at the nest. Small chicks beg with soft cheeping calls that become insistent clucking, mewling, squealing and then braying notes, as the birds become older and hungrier, and calling can even continue at night.



Mobile prey, as in this case a grasshopper, is immobilized with the short, thick toes by means of powerful, well directed stamps. Because the bird's neck is very short in comparison with its lanky legs, it must then bend forward, flexing its legs, in order to pick up the prey item in its bill.

[*Sagittarius serpentarius*.
Photos: Clem Haagner/
Ardea]

The Secretarybird's short toes, well adapted for walking long distances, are quite unsuited for grasping and carrying prey, so these actions must be performed with the bill. Prey varies considerably in size, ranging from fairly large insects to sizeable snakes and fully-grown hares, but even the largest prey items are normally swallowed whole. This bird has drawn the nictitating membrane, or third lid, over its eye, a practice that in many species seems to be linked with rapid head movements, for instance when the bird is manipulating prey. It is thought that the function might be to block out the blurred images caused by such movements.

[*Sagittarius serpentarius*,
Kenya.
Photo: Sean Avery/
Planet Earth]



Food and Feeding

The prey of Secretarybirds consists of any small animals that can be overcome by the fast hard kicks rained down with the long legs and stout toes. The same technique is applied across the whole size spectrum, from small moths to full-grown hares. The bulk of the diet by number is comprised of arthropods, in particular grasshoppers or locusts and sometimes large beetles, although small vertebrates often form the main biomass. The fast movements of rodents and lizards are no match for this dexterous hunting technique, which can also be used to surprise birds such as warblers, larks, doves and small hornbills. Larger prey and snakes are dispatched by blows directed mainly at the head, but there is no evidence of the wings being used in attacks other than for balance and lift.

The most rewarding kinds of prey are such large items as frogs, snakes, including poisonous adders and cobras, lizards, chameleons, gamebirds or plovers and their chicks, rats, shrews, hedgehogs, small felids, mongooses and meerkats. All but the largest prey is swallowed whole, including small tortoises and hares. Large prey may also be cached under a bush and collected later, especially when the birds are breeding. Careful searching also reveals birds' nests, the eggs or chicks of which are picked up and swallowed whole without any kicking, as is the case with other very small or immobile types of prey, such as termites or carrion found lying around after a fire. Even golf balls, lost in the rough, are also mistaken for eggs and swallowed at times. Rarely, prey such as wasps and their nests may be picked directly from vegetation with the bill.

Hunting birds appear to view only a fairly narrow field as they stalk across the veld, moving more slowly and deliberately the taller and denser the ground cover. They walk with a stride of about 40 cm, at about 120 paces/minute and an average of 3 km/h, but they sometimes accelerate or break into a run if

the presence of prey is suspected ahead. They may also stop to kick repeatedly at grass tufts or piles of dung in an attempt to flush prey. The long crest feathers are often raised during hunting, forming a halo around the bird's head that may assist in scaring out prey and shading the face. The exact stimuli for crest erection at other times are not consistent, for example during social encounters or changes in activity.

Indigestible food remains are regurgitated as large pellets, 40-45 mm in diameter and 30-100 mm long. These are often dropped on or in the vicinity of the roost and nest trees, but they may be cast at any time of day, even while the bird is incubating. Analysis of fragments and hair found in pellets is an important indicator of the prey taken. Pellets also often include quantities of grass or small stones, of uncertain dietary significance. Chicks begin to produce pellets from about one week of age, usually once a day in the early morning.

Encounters with other predators are rare except for piracy by Tawny Eagles (*Aquila rapax*), which may attack singly or in pairs. The eagles often steal larger prey from the Secretarybird, such as snakes or mongooses, although sometimes they are beaten off by combined attacks from a pair, or are even bettered and pinned down on the ground. A *Circaetus* snake-eagle was also seen to take a snake which a Secretarybird had dropped while in flight, but there are also questionable reports of Secretarybirds dropping snakes to kill them. One attacked a young Jackal Buzzard (*Buteo rufofuscus*) but was driven off and possibly mortally wounded by the parents.

Breeding

Much of the range of the Secretarybird experiences alternating wet and dry seasons, and chicks are most often reared during the wet season when the savanna is most productive of small animals. However, when food supplies are extended, during



In addition to the typical undulating aerial displays, courtship also includes displays on the ground. These consist of one bird chasing the other, twisting and turning, with its wings raised up over its back. A similar form of behaviour often occurs in territorial defence, with the defender often leaping at the intruder and kicking out at it. Such situations can develop into real kicking fights, and both members of the pair sometimes join in to repel an intruder.

[*Sagittarius serpentarius*,
Kalahari Gemsbok
National Park,
South Africa.
Photo: Philip Perry/FLPA]

seasons of above average rainfall, or when rodent or locust numbers are high, successive breeding attempts may occur, with intervals of as little as three weeks between broods. Hence egg-laying may be expected at any time of the year with chicks sometimes being raised well into the dry season. Furthermore, pairs in the same area may have different breeding schedules with some being regular and seasonal and others more erratic and aseasonal.

An increase in soaring and calling high above the nest area heralds the onset of breeding. One or both members of a pair may also perform pendulum displays for as long as 15 minutes, stalling and then swooping down with wings closed, only to swing up again and repeat the whole performance. Alternatively, they may swoop at one another and roll over to present the feet, even when one bird is on the ground near the nest.

Back to earth, usually in the morning after leaving the roost, the canopy of a tree is trampled flat, and then sticks and weed stems are collected in the bill before being carried to form the nest. This develops into a platform 1-2.5 m in diameter and 30-50 cm deep, and grass tufts, picked up or ripped out with the bill, form the main lining, together with some small sticks, wool, animal dung, leaves and other debris collected nearby. Both sexes build, although the male brings more material and the female spends more time arranging this on the nest.

Display, building and even sitting for extended periods may proceed at the nest-site for up to six months before egg-laying, if suitable conditions are delayed. The same site may be used in successive seasons but an alternative site may be used, especially since the bulky structure often either collapses in the centre or tilts to one side. Nests are sometimes taken over by other raptors such as Lappet-faced Vultures (*Torgos tracheliotus*) or Greater Kestrels (*Falco rupicoloides*). Copulation is

reported to take place on the ground or a tree, but it has not yet been described.

One to three eggs are laid, with two the most common clutch size; the eggs are smaller and more numerous than would be expected for a bird of prey of similar size. Both the eggs themselves and the clutch size are more like those found in storks, being chalky in texture, plain white or pale blue-green, rather pointed at one end and only rarely blotched or streaked with pale brown and rufous.

The parents usually share incubation, and later brooding of the chicks, one bird sitting on the nest while the other is away foraging. This may vary between pairs, since in some cases the male regurgitates food at the nest, whereupon the female eats this and then continues with the incubation. At the changeover, the returning bird usually picks up some lining as it approaches the nest, before flying on to it, at which point the sitting bird rises and usually performs a bowing display before departing, raising and lowering the head, in a manner similar to the "Up-down" display of many storks. The display, at highest intensity, includes the croaking call, fanning of the tail almost vertically above the back and exposure of the voluminous white undertail-coverts at each bow. It is performed most commonly during nest building and the early stages of incubation.

Incubating birds sit very tight, lying flat in the nest if approached, with only the long tail protruding over the nest rim, but if accosted, they sometimes stand and threaten with wings raised. Some chicks also threaten intruders by puffing out the neck, tossing back the head, opening the wings, croaking loudly and sometimes even throwing up their food.

The eggs measure 68-92 x 51-65 mm, with an average of 78 x 56 mm; they often become deeply stained during incubation. They hatch after a period of 42-46 days, having started to

pip about two days earlier. They are laid two to four days apart and retain that interval for hatching, since incubation begins with the first egg. The chick is covered in pale grey down at hatching, darkest on the dorsal surface and palest below. The head appears large, and the large brown eyes open within hours. The cere, gape and skin around the eyes are pale orange while the legs are pale grey. The bill is black with a pale orange tip and there is already a protuberance at the back of the head from which the crest feathers will sprout.

A second coat of pale grey down appears by the time the chick is about two weeks old, and at this stage the pale yellow facial skin is prominent. When it is about three weeks old the crest feathers appear, and by five weeks old the upperparts are largely feathered. The chick can stand at four to six weeks old, and by seven weeks old it is fully-feathered and starts flapping exercises. Thereafter, feather growth proceeds only in the flight-feathers and the tail, until the bird is ready for fledging.

A parent remains in attendance at the nest throughout the first two or three weeks after hatching, whereafter the chicks are able to thermoregulate and are left for extended periods during the day, but are still brooded at night and during bad weather. However, one parent usually remains in the nest area until the chicks are four to six weeks old, rushing to their defence if a falcon or crow passes nearby, but later on chicks are usually left alone, even at night, except for brief visits with food.

The parents take turns to feed the chicks. They return to the nest with the crop full of food, either after walking back to the nest or after descending from a high soar, which is the quickest and most economical way to return from the borders of the territory during the heat of the day. Rarely a large food item, such as a snake or a mongoose, is carried in the bill, although this renders the Secretarybird vulnerable to piratical attacks by Tawny Eagles, in areas where both species occur.

The first visit with food is usually in the late morning, followed by others at mid-afternoon and in the evening. This gives the parent several hours to find food for itself and then

fill its well developed crop before returning to the nest. Food may be brought at any time, depending on what is available and how close it is found to the nest, but usually only three to five feeds are delivered daily. Sometimes, later in the nestling period, both parents will return together with food.

The food is regurgitated onto the nest floor, from where the parents pick up or tear off scraps to feed small chicks. Within two or three weeks of hatching, the chicks are able to pick up and swallow some of their own food, and by six weeks old they gobble down most prey into their wide gapes, so that feeding visits become brief, but hectic, scrimmages of only two to five minutes. One adult, usually the female, may sometimes swallow food delivered by the other, which it later regurgitates to the chicks at intervals, or from which it produces some liquid. Tearing of prey by the chicks does not begin until they are about 40 days old, as they need to be able to stand and balance well on their long, rather brittle legs.

The adults also trickle a liquid, probably mainly water, directly into the chicks' bills. This may include partly digested food, which is possibly of some importance in the diet of small chicks, although even day-old chicks are fed directly on whole food items, and they may not receive liquid for days, yet they continue to receive fluid almost until fledging. The chicks take the parent's bill inside their own when drinking, swallow repeatedly, as shown by the pumping action of the tongue, and maintain a fast, steady patter with the lower mandible against the adult's bill, which may stimulate the release of fluid. This pattering with the bill may even lead to stork-like bill-clapping in hungry fledglings. Food has to be torn up while standing, but fluids may be dribbled to the chicks while the adult kneels in the nest.

Later in the nesting cycle, water is often specially drunk near the nest and dribbled into the chick's bill, especially on hot, dry and windy days. Sometimes the chicks refuse to feed until supplied with water and, if they have water readily available, hand-reared nestlings drink regularly. No observations at nests in waterless areas are documented. Some food items are

Both sexes take part in the building of the nest. The necessary sticks and stems are collected within the immediate vicinity of the nest, and are invariably transported in the bill, as the feet are useless for this purpose. The nest is typically sited on the top of a thorny tree, very often a dense, flat-topped Acacia. The sexes are very similar or perhaps even identical in terms of plumage, but there appears to be a slight degree of size dimorphism. Recent prolonged observations of several pairs at their nests suggest that, contrary to the traditional view, it is, in fact, the females that tend to average a little larger.

[*Sagittarius serpentarius*,
Etosha National Park,
Namibia.
Photo: Des & Jen Bartlett/
Survival]





The Secretarybird's nest tends to be sited in a fairly low tree, and is usually only about three to seven metres above the ground. For security against predators, it appears that the height of the tree is less important than is the presence of a thick, impenetrable layer of thorns, which provides effective protection from below. However, this is not sufficient protection against human ingenuity, and birds can hardly ever breed successfully near areas of dense human population, where the nests are commonly disturbed and eventually destroyed by children. The species is normally found in open country, typically grassy plains, semi-arid savanna, Karoo scrub and sub-deserts; it also frequents open woodland, but avoids closed habitats, such as forest.

[*Sagittarius serpentarius*,
Masai Mara National
Park, Kenya.
Photo: Günter Ziesler]

Incubation lasts about 45 days and, as far as is known, is performed entirely by the female; during this period the male frequently brings food to her at the nest. This bird is panting, a mechanism that Secretarybirds use for keeping cool when they are exposed to high temperatures. The species may actually be rather sensitive to heat, which might explain its absence from certain hot lowland areas, which in other respects appear to be ideal for it. Note the characteristic brightly coloured bare facial skin, which tends to be slightly more extensive in females than in males.

[*Sagittarius serpentarius*,
Tsavo East National Park,
Kenya.
Photo: Bruce Davidson/
Survival]



repeatedly reswallowed and regurgitated by the parents during feeds, probably in order to clean the nest, nourish the parent or control the flow of liquid. The roles of the sexes, regurgitation of food and transport of water are all forms of behaviour that are more reminiscent of storks than of other birds of prey.

The nestling period is variable, even within the same brood, with a range of 65-106 days, but it usually lasts 75-85 days. Its duration probably depends on the food supply available and can end prematurely at 47-54 days, if a chick is blown off the nest when feeding or exercising. Often one or more of the younger chicks in a brood develops more slowly, or starves, even after surviving long into the nestling period, and on rare occasions even cannibalism of deceased chicks has been recorded. Well nourished chicks grow from about 56-83 g at hatching to the adult weight of about 2.3-4.3 kg by eight weeks old. Three chicks are rarely reared, and the third egg often fails to hatch and may even be carried some distance from the nest by the parents.

The fledgling remains in the nest area, being fed by the parents, either on the nest or while crouching on the ground nearby. It usually also returns to roost on or below the nest tree. It soon begins to practise kicking and hunting, and can even catch its first prey within a fortnight. However, it has first to learn to fly back onto the nest, walk without tripping all the time, avoid walking into thorns and fly over rather than squeeze through fences. After about four to eight weeks it joins its parents on feeding forays, until leaving the area and becoming independent a few weeks later. Some juveniles may still return to roost in the nest area three months after fledging, lying on the nest with the head tucked under the wing as they did when still chicks. The age at first breeding remains to be discovered.

Breeding frequency and success are highly variable. On one territory in natural habitat in Kenya, only one attempt was successful, with two chicks fledging, over a period of six years. In another area of Kenya, three out of five pairs bred one year,

but only fledged two chicks from one nest; the next year only one pair was present and this did not breed; and in the third year no pairs were present. On three territories on farmland in the Transvaal, South Africa, at least 14 chicks were fledged in 26 pair-years between 1974 and 1988. Most failures in each study were due to adult or nestling persecution. Crows, ravens, Verreaux's Eagle owls (*Bubo lacteus*) and Southern Ground-hornbills (*Bucorvus leadbeateri*) have all been implicated in predation of nestlings, but despite all this, broods of three chicks are sometimes raised. Adults have perished from collisions with motor vehicles, utility lines and aircraft, by being bitten on the wing by a poisonous snake, from eating poisoned carrion, by becoming entangled with large snakes, by being stoned on the nest and from infection with the protozoan *Trichomonas gallinae*.

Movements

No regular migratory movements are described. However, much of the range of the species experiences ephemeral conditions based on the timing, extent and quantity of rainfall, grazing and fires.

In the most stable habitats, pairs may reside on the same territory and breed regularly for many years in succession. In less mesic areas, pairs may form and breed for only a season or two and then be absent for several years. In the most arid areas, nomads may only stay for a brief temporary visit or for a single breeding attempt.

Relationship with Man

Traditionally, the Secretarybird has not been molested by African peoples. Its distinctive appearance is striking, and its



When the chicks are small, the adults feed them on a liquid diet that is thought to be composed mainly of partially digested insects. Often, as in this case, and especially in clutches of three, one of the eggs turns out to be infertile. In fact, there is no record of three chicks at a nest ever having been reared to fledging, and it is only rarely that two young are fledged, even though there is no aggression between siblings. This chick is clothed in its first coat of down, which can be white or pale grey; two weeks after hatching this will be replaced by a second coat of thicker, darker down.

[*Sagittarius serpentarius*, South Africa.
Photo: Ardea]

ability to deal with large poisonous snakes and other vermin has been admired by many peoples, including European settlers who introduced fines designed to encourage its protection. It is now protected by law in many African states, but at the same time traditional observances are declining and cases of interference are increasing, especially at roost- and nest-sites. Its preference for running to safety unless there is thermal lift to assist flight makes it vulnerable to hunters using packs of dogs or motor vehicles.

The common name was originally thought to refer to the long crest feathers which can appear like quill pens stuck behind the ear of a medieval scribe. However, a recent proposal suggests that it is a Francophone corruption of the Arabic *sagret-tair* or "hunter-bird".

The species adapts well to captivity and has been bred repeatedly by several avicultural institutions, since the last century. It is also reported to make good eating.

Status and Conservation

The Secretarybird is widespread and common over much of its range. Importantly, this is the case in a number of the larger game reserves and national parks. It is also common in many inhabited areas and under various agricultural regimes. In some areas of Kenya, it has even been found to be commoner around

cereal croplands, where rodents abound, than in adjacent livestock areas or game reserves where arthropods alone formed the bulk of the prey. Exotic trees planted on open grasslands have also provided suitable sites for nesting and roosting, where none existed previously.

However, it has also declined in some areas, as human population densities and nest interference increase, and as excess livestock lower the productivity of some savanna regions. Clearing of areas of dense bush, woodland and forest for agriculture may have opened up some new areas for occupation, but at the same time afforestation of grasslands has decreased habitat, especially in South Africa. However, the nomadic nature of the species makes it difficult to assess long term population trends in any given area.

The total population in Africa has never been estimated but is expected to be in the tens of thousands, with 1068 breeding pairs estimated for the 286,000 km² Transvaal Province of South Africa alone. Fluctuations in population size are expected, given the cyclical nature of the climate over much of its range, but the species must be considered capable of rapid recovery, given the large clutches, abbreviated nestling periods and propensity for raising multiple broods which it exhibits under ideal conditions. Such flexible and productive breeding biology is unusual for such a large bird of prey, but is ideally suited to the variable climate of the African savanna, and is similar to that of several African stork species.



PLATE 23

inches 16
cm 40



inches 8
cm 20

Family SAGITTARIIDAE (SECRETARYBIRD) SPECIES ACCOUNTS

PLATE 23

Genus *SAGITTARIUS* Herman, 1783

Secretarybird

Sagittarius serpentarius

French: Messenger serpenteaire

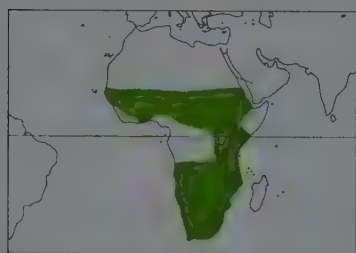
German: Sekretär

Spanish: Secretario

Taxonomy. *Falco serpentarius* J. F. Miller 1779, Cape of Good Hope.

Shows most morphological, behavioural and molecular affinities with Falconiformes, especially Accipitridae. Also some behavioural affinities with Ciconiidae. Proposed relationships to Cariamidae and other Gruiformes unsubstantiated. Birds of W Africa have occasionally been awarded separate race, *gambiensis*. Monotypic.

Distribution. Senegambia E to Ethiopia and Somalia, and S to South Africa.



Descriptive notes. 125-150 cm; c. 2300-4270 g; wingspan 212 cm. Unmistakable, with long pink legs, long black crest feathers, bare orange face, hooked aquiline bill and long central tail feathers. Grey above, white below with black flight feathers, abdomen and thighs. Female probably slightly larger. Juvenile similar to adult with grey barring on white underwing- and undertail-coverts; also paler face; brown edges to grey dorsal feathers, especially in juvenile female. Eye changes from grey to brown and bill from black to blue-grey when adult.

Habitat. Steppe or tree and grass savanna, favouring short grass with scattered *Acacia* thorn trees to provide sites for roosting and nesting. Rarely visits clearings in woodland or forest.

Food and Feeding. Mostly arthropods, especially grasshoppers and beetles, but devours most small animals including frogs, lizards, tortoises, snakes, rodents, hedgehogs, mongooses, squirrels and hares. Usually kills prey by fast kicks with the long legs and stout toes, swallows it whole with the wide gape and only tears larger prey while holding it down with the inner toes. Usually hunts alone or with mate in close proximity.

Breeding. Nests at any time of year when food abundant, usually to fledge chicks in period of summer rainy season abundance. Territory of 25-45 km², each pair placing large nest platform of sticks and grass on top of low tree. Normally 2 eggs (1-3); incubation 42-46 days; chicks hatch in pale grey down with short straight bill, second dark grey down by 3 weeks, well feathered by 6 weeks; nestling period variable at 65-106 days. Only rarely 3 chicks raised, but pair may have successive broods with intervals of less than a month between them.

Movements. Sedentary with regular seasonal breeding in some areas, but nomadic in most areas in response to changes in rainfall, grazing and fires. Adult males usually last to forsake territories; juveniles wander widely in search of areas unoccupied by mated pairs. May enter and breed regularly in an area for several years and then be absent, or only prevent in much reduced numbers.

Status and Conservation. Not globally threatened, CITES II. Widespread and often locally common, both in protected natural areas and in various forms of extensive agriculture. Often protected in recognition of snake and rodent killing abilities, but sometimes persecuted at low accessible nest-sites. Afforestation of grasslands and intensive land use have eliminated habitat, with some compensation where bush has been cleared for grazing or croplands. No total population estimates but over 1000 breeding pairs thought to occur in Transvaal Province of South Africa alone. Protected under CITES, due to pressure of live animal trade. Has been bred several times in captivity.

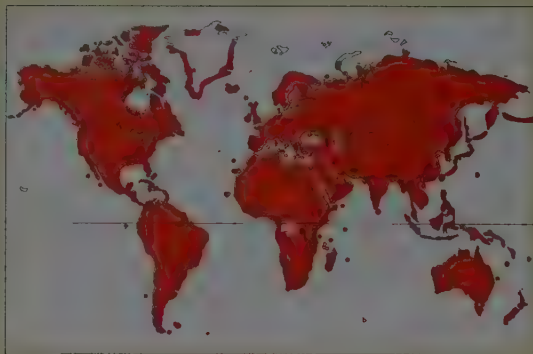
Bibliography. Akesson (1991), Bannerman (1953), Barnard & Simmons (1985), Benirschke (1977), Benson & Benson (1975), Brooke & Hodgson (1971), Brothers (1975), Brown (1952, 1955), Brown & Amadon (1968), Brown *et al.* (1982), Burton & Boyer (1989), Colahan & Ferreira (1992), Cracraft (1981), Day (1984), Fedducia & Voorhies (1989), French-Constant (1985), Fry (1977), Ginn *et al.* (1989), Haagner (1913a), Hartley (1992), van der Heiden (1992), Hendry (1960), Karmali & Karmali (1968), Kemp (1985), Kemp & Kemp (1978), Koyama *et al.* (1971), Macdonald & Gargett (1984), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Malory *et al.* (1987), Miller (1947), Mourer-Chauviré & Cheneval (1983), Mundy (1988), Newman (1970), Pickford *et al.* (1989), Pinto (1983), Read (1987), Renshaw (1917), Roberts (1940), Rutgers & Norris (1970), Searle (1992), Sibley & Ahlquist (1990), Sibley *et al.* (1988), Smeenk (1974), van Someren (1956), Spawls (1986), Steyn (1959, 1961a, 1961b, 1982), Steyn & Myburgh (1991), de Swardt (1990a), Tarboton & Allan (1984), Todd (1988), Wennrich (1984).

Class AVES

Order FALCONIFORMES

Suborder FALCONES

Family FALCONIDAE (FALCONS AND CARACARAS)



- Small to medium-sized predatory birds with hooked bill and usually raptorial talons.
- 14-65 cm.



- All regions except Antarctic.
- All habitats, from tundra to desert to tropical forest.
- 10 genera, 61 species, 149 taxa.
- 5 species threatened; 1 subspecies extinct since 1600.

Systematics

On first inspection, the 59-63 species of Falconidae do not appear to be a well defined family, because of their great diversity of lifestyles. They range from long-winged falcons (*Falco*) of open country to scavenging, ground-dwelling caracaras (*Polyborus*) reminiscent of vultures; from arboreal, almost chicken-like caracaras (*Daptrius*) to forest-falcons (*Micrastur*) of tropical forests that resemble true hawks (*Accipiter*) with their short wings; and tiny falconets (*Microhierax*), which are only the size of a thrush or even a finch. They are, however, all united taxonomically by at least six or more distinctive morphological characteristics, including, for example, a characteristic flight-feather moult pattern (starting with primary 4), a bony tubercle developed to one degree or another in the nostril (except in forest-falcons), the same *Mallophaga* feather lice, and eggshells of the same chemical composition. In addition, except in the case of the pygmy-falcons that have white eggs, their eggs are all blotched and spotted reddish brown, and, rather than the greenish internal tint of accipitrid eggs, the shells have a reddish yellow translucence.

Since the time of Linnaeus, the Falconidae have generally been placed alongside the other diurnal raptors, including hawks, eagles, kites and other groups now included in the order Falconiformes. This approach has been supported by diverse pieces of evidence from traditional studies of external morphology, internal anatomy, behaviour, feather parasites, and moult patterns, as well as more recent molecular evidence based on comparisons of feather proteins, allozymes and DNA. However, M. Jollie made detailed studies of the morphology of families traditionally included in Falconiformes, and he concluded that the order is polyphyletic. Reviving an old notion, he suggested that falconids were not related to accipitrids, but were actually closer to owls, parrots, cuckoos and plantain-eaters. Most modern authorities, however, regard the shared features of falcons and owls to be convergent, and virtually all recent comprehensive avian family classifications have retained the place of Falconidae within the order Falconiformes.

On very fragmentary evidence, a tiny fossil, smaller than contemporary falconets (*Microhierax*), was reported as a new genus of falconid from the lower Eocene of England, about 55 million years ago. The first well documented falconids, however, were described from the Eo-Oligocene in France, and date to about 36 million years ago. From North and South America

the group shows up in the Miocene, about 23 million years ago. Such early representatives included *Badiostes*, a group with characteristics of caracaras, and early examples of the contemporary genus *Falco*. Several other extinct genera and species have been described. While not extensive, the family has a fossil history as old as divers (loons) and tinamous, which are generally regarded as more "primitive" groups.

There are no good clues to indicate where the family might have originated geographically. Because of their molecular traits, the contemporary species of falcons (*Falco*) are thought to have had a rather recent, explosive and rapid radiation, probably in the late Pliocene and Pleistocene, and all are closely related. At least 20 living falconid species are known from the Pleistocene, which lasted from approximately 1.85 million to 10,000 years ago. The fossil record does not contain contemporary species back beyond about 2 million years. Nor does



Subdivision of the
Falconidae.

[Figure: Ian Willis &
Hilary Burn]

the existing record provide evidence for contemporary species being united in some fashion as Gondwanan groups, although the basic stocks that gave rise to subfamilies, clades and genera certainly could have been Gondwanan.

Most of the diversity within the family is concentrated in the Neotropics among genera of caracaras, forest-falcons, the Laughing Falcon (*Herpetotheres cachinnans*), the Spot-winged Falconet (*Spizapteryx circumcinctus*) and the true falcons; here are found eight of the ten falconid genera, with seven of them endemic. Of the 39 or so species of *Falco*, 17 breed in Africa and associated islands, with ten of these endemic, while another six boreal species winter there. Of the aforementioned 17 species, 10 are kestrels (comprising 76% of all kestrel species), and these include the species that are thought to be the most primitive kestrels. Thus, Africa and its satellite islands form a centre of diversity for the kestrels and perhaps for the entire genus *Falco*.

Concerning the systematics of the family, there are four main issues that dominate discussions and investigation: how many subfamilies should be recognized within the family, and the composition of each of these; the relationships between the various different genera, and how these relationships should be reflected in a linear sequence; how many species there are, and the relationships of the different species within various genera; and, finally, what name should be used for particular species or genera. In themselves, names are, of course, not of great importance, but the information they convey suggests evolutionary and systematic relationships.

At the subfamily level, two, three or four groups are variously identified. Most modern classifications (as here) recognize two subfamilies, with the falcons and falconets forming a single subfamily, although the Spot-winged Falconet is sometimes placed in the other subfamily, alongside the caracaras. A typical treatment with three subfamilies has the caracaras

in one subfamily, the Laughing Falcon and the forest-falcons together in another, and all other species in a third subfamily. A variation of this is to place caracaras in one subfamily, forest-falcons in another, and all other species in a third. Finally, a few authorities have recognized four subfamilies by separating falconets from *Falco*. There is general agreement that the caracaras are more closely allied to the forest-falcons than to the clade or clades containing the falconets and *Falco*. Beyond these broad details, most of the recently suggested schemes based on data from the analysis of DNA, allozymes and morphology present some major differences. In several major contemporary classifications, the monotypic genus *Herpetotheres* is placed near either forest-falcons or true falcons, or it is placed together with another monotypic genus, *Spizapteryx*, of South America, in an entirely separate clade. The overall situation is made all the more confusing by the lack of agreement thus far between various molecular and morphological data sets. It appears that a universally acceptable arrangement of the groups of species within Falconidae must await the refinement of current quantitative methods and systematic techniques, or the development of better ones.

Within the large genus *Falco*, there is such an array of falcon types, ranging from largely insect-eating kestrels to the almost exclusively bird-eating Peregrine Falcon (*Falco peregrinus*), that little agreement has emerged on the internal arrangement and relationships of the species. Regardless of the analysis technique applied, the correct arrangement should be consistent within historical and biogeographical contexts. The linear sequence followed here is a compromise between several arrangements and is based on the most recent and convincing data.

There are several groups that fit together nicely. A notable example is supplied by the large Arctic or desert falcons with soft, lax plumage, the Gyrfalcon (*Falco rusticolus*), the Saker

The systematic position of the Spot-winged Falconet is much disputed, and it is variously associated with different genera.

At present, many authorities consider it closest to the Old World genus *Polihierax*, and thus include it in the subfamily Falconinae, alongside the falconets and true falcons. However, some authors feel that it is more likely to be related to other Neotropical genera, especially *Herpetotheres* or *Micrastur*, and thus place it in Polyborinae. It might represent some form of link between the two subfamilies, or perhaps even merit isolation in a third subfamily; for the moment, nobody can be sure.

[*Spizapteryx circumcinctus*.

Photo: H. Rivarola/
Bruce Coleman]





The Brown Falcon has been separated from other falcons in the genus *Falco* (Falconidae), either alone or along with its closest ally, the New Zealand Falcon (*Falco novaeseelandiae*). However, in spite of the Brown Falcon's very long legs and its rather terrestrial hunting habits, it appears to be a true Falcon in most respects. Seven different subspecies have been described, but recent study suggests that some of these have been erected due to confusion with the strikingly different colour morphs, and at present only three races are considered valid.

[*Falco berigora*, Australia. Photo: J. J. Brooks/Aquila]

Falcon (*Falco cherrug*), the Lanner Falcon (*Falco biarmicus*) and the Laggar Falcon (*Falco jugger*). The hobby group, of four to six species, contains the Eurasian Hobby (*Falco subbuteo*), the African Hobby (*Falco cuvierii*), the Oriental Hobby (*Falco severus*) and the Australian Hobby (*Falco longipennis*); also included sometimes are Eleonora's Falcon (*Falco eleonora*) and the Sooty Falcon (*Falco concolor*), both of which breed from late summer to early autumn around the Mediterranean and North Africa, and migrate to winter mainly in Madagascar. Another well defined group comprises the kestrels, except the three grey species of Africa and Madagascar, Dickinson's Kestrel (*Falco dickinsoni*), the Grey Kestrel (*Falco ardosiaceus*) and the Banded Kestrel (*Falco zoniventris*). The latter are considered to form a discrete group in several analyses, and they have been regarded as aberrant kestrels; too much weight may have been given to their distinctive grey colour, but even feather protein has shown them to be distinct from other kestrels.

Some recent data concerning chromosomes, DNA sequences and behaviour suggest that the Prairie Falcon (*Falco mexicanus*), most frequently allied with large desert falcons, a relationship supported by feather protein data, may actually be more closely related to the Peregrine Falcon. The courtship vocalizations of these two species share some of the same sequence, repertoire and types, and these differ from those found in desert falcons; also, both have 48 chromosomes, rather than the 52 of the desert falcons. The Red-footed Falcon (*Falco vespertinus*) and the Amur Falcon (*Falco amurensis*) have alternatively been treated as races of the same species, as separate species, or as a species pair; they are reckoned to be allied to either kestrels or hobbies. As yet, there are no complete molecular data to shed light on the taxonomic status of these two forms.

Feather protein data indicate that the Black Falcon (*Falco subniger*) and the Grey Falcon (*Falco hypoleucos*), both Aus-

tralian endemics, might be closer to one another and allied to the hobbies, rather than belonging in different subgenera, as proposed in some schemes; the same may also be true for two other Australasian endemics, the Brown Falcon (*Falco berigora*) and the New Zealand Falcon (*Falco novaeseelandiae*). Lastly, the Aplomado Falcon (*Falco femoralis*), the Bat Falcon (*Falco rufigularis*), and the Orange-breasted Falcon (*Falco deiroleucus*) are more closely related to one another than to other groups, as suggested by shared endemic Neotropical distribution and behavioural traits, including courtship, vocalization, and sun-bathing postures, yet all three have at times been assigned to different subgenera, with the Orange-breasted Falcon placed near the Peregrine Falcon. Where these species fit in a linear arrangement within *Falco* is uncertain.

At the level of species, disputes revolve around several taxa, and there seems to be no pending resolution to these questions, since even available molecular analyses are at variance and are not definitive. For example, the Mountain Caracara (*Phalcoboenus megalopterus*) is a species of the puna and high Andes of western South America, south to at least Bolivia and north-west Argentina. Another similar species, the White-throated Caracara (*Phalcoboenus albogularis*) appears in northern Chile, south of the range of the former and extending southward to Tierra del Fuego. It differs from the Mountain Caracara by having entirely white underparts, whereas the former has only the lower third of the underparts white. Because some specimens appear to be intermediate between them, suggesting intergradation, *albogularis* is often treated as a subspecies of *megalopterus*, yet it is seemingly a good species, and these two probably form a superspecies, along with the Carunculated Caracara (*Phalcoboenus carunculatus*). The extinct Guadalupe Caracara (*Polyborus plancus lutosus*) has endured, albeit posthumously, considerable taxonomic debate over its taxonomic status. Perhaps DNA from the feather quill pulp of a study skin might show whether it was merely a

subspecies of the Crested Caracara (*Polyborus plancus*) or a full species, although the question is, lamentably, now one mainly of academic interest.

The secretive forest-falcons are hard to study in their tropical forest habitat, since they tend to frequent the canopy of forest interiors. Some species are rare in museum collections and so presumed to be rare in the field. The first study on the breeding biology of the genus was only completed in 1992, and thus it is not surprising that their taxonomic status is muddled. The Barred Forest-falcon (*Micrastur ruficollis*) and the Lined Forest-falcon (*Micrastur gilvicolis*) were both described in 1817, only a single page apart in Vieillot's treatise on new Neotropical birds. Some authorities consider them conspecific, with *gilvicolis* a subspecies of *ruficollis*, but they are sympatric in Venezuela and the Guianas without interbreeding, have different numbers of pale bars on the tail, and have different calls, all characters suggesting they are good phylogenetic species. In 1918, the Plumbeous Forest-falcon (*Micrastur plumbeus*), another species similar to the Lined Forest-falcon, was described from populations in north-west Ecuador and adjacent Colombia. It is often considered conspecific with the latter, but its isolation and certain morphological differences, including a shorter tail with a single pale bar, suggest that it is indeed a valid species. As with caracaras, there is no consensus on the nature or degree of character differences that should be regarded as indicators of full species status.

In 1891, a dark brown to bluish falcon from the Altai Mountains that mark the joint borders of Russia, Mongolia and China, was named as "*Falco altaicus*", the Altai Falcon. The original species description was based on an adult male collected at the eyrie, one of its young in juvenile plumage and four other siblings that were kept alive until they died at various ages in different plumages. In combination, a few traits from these specimens, especially the bluish cast to the adult's upperparts, are somewhat intermediate between those found in the Saker Falcon and the Gyrfalcon. These characters were explained as indicating hybridization between these two species, with the Altai Falcon thus regarded as a hybrid form, or grounds for considering it a subspecies of either of them or a full species in its own right. It is now known that dark "Altai-type" nestlings from the south flank of the Altai Mountains in Kazakhstan

may have pale, typical Saker-like siblings. DNA fingerprinting analysis of one "*altaicus*" individual by J. Longmire showed that its mother, at least, was a Saker Falcon; it was not intermediate, nor a different species. As yet, insufficient specimens of "true *altaicus*" are available from the breeding grounds of this enigmatic form to yield enough molecular data to answer this intriguing problem. If not a phylogenetic species, and thus a close allospecies of the Saker, then "*altaicus*" may well be a subspecies of it. Could it therefore be a form in the process of speciation?

Among Peregrine-like falcons, there are those with a dark bluish or black head and neck, and those with a rufous nuchal collar and head and a proportionally shorter tail. The rufous-headed form *pelegrinoides*, the Barbary Falcon, is often regarded as a species separate from the Peregrine Falcon. Full species status is supported by skeletal and feather protein characters. However, because of its distribution relative to dark-headed Peregrines in North Africa, some contact zones with hybridization, the impossibility of distinguishing the two forms using DNA from cytochrome *b* genes, a lack of distinctive behavioural differences, and complete interfertility in mixed pairs in captivity, the Barbary Falcon seems actually to be a subspecies of the Peregrine Falcon, or at least a very close allospecies. Again, some authorities regard it as a full phylogenetic species, or another form that is in the process of speciation.

The classification of the caracaras has undergone several proposed but disputed changes. Traditionally, most authorities have recognized four genera (*Daptrius*, *Phalcoboenus*, *Polyborus*, *Milvago*) containing 9-11 species. A major study of caracaras in the 1970's by F. Vuilleumier analysed six aspects, namely size, proportions, plumage colour and pattern, bare facial skin, nostril shape, and habitat preference. The study suggested that all of the species, except *Daptrius*, be lumped into a single genus, *Polyborus*. This lumping resulted in the arrangement of two groups, the "forest caracaras", comprising the two species of *Daptrius*, and the "non-forest caracaras", with the remaining five species joined in *Polyborus*. Several later studies, using DNA-DNA hybridization, an analysis of 37 characters (including behaviour, genetics and morphology), and features of syringeal morphology, however, supported the no-

Amongst the most characteristic features of falcons (lacking in the *Polyborinae*) are the tomial teeth on the upper mandible, which are thought to serve mainly in the process of killing prey by breaking the victim's neck, although they may be equally important for dismembering tough parts of prey. Other specialities visible in this immature Laggar Falcon include the bony tubercle in the nostrils, the bare orbital skin and the dark moustachial streak, which may be connected with reducing glare.

[*Falco jugger*.
Photo: Rod Williams/
Bruce Coleman]





tion of keeping separate the genera lumped by Vuilleumier into *Polyborus*. In addition to this *Polyborus* question, the two species in *Daptrius*, the Black Caracara (*Daptrius ater*) and the Red-throated Caracara (*Daptrius americanus*), are quite different in behaviour, habitat and syringeal morphology, so an earlier name, *Ibycter*, may be appropriately revived for the latter species; this question awaits further study and interpretation. Recently, it has been shown that the time-honoured generic name *Polyborus* was originally applied to a form of uncertain identity. As a result, it has been proposed that *Caracara* should therefore substitute it as the name for this genus. However, not only has *Polyborus* been used almost universally for over 150 years, but it is also the basis of the subfamily name Polyborinae. In the interests of stability, one of the overriding principles in zoological nomenclature, it seems likely that *Polyborus* will be retained.

In addition to caracaras, at least three other taxa have had their generic situation disputed, reflecting uncertainty about their affinities. Among the Old World pygmy-falcons currently placed in the genus *Polihierax*, one occurs in Africa, while a larger species with different morphology and a different colour pattern occurs in Asia. Recent studies on syringeal morphology by C. Griffiths indicate that the African Pygmy-falcon (*Polihierax semitorquatus*) clearly is related to other falconets, such as those from Indonesia and South America, but the White-rumped Pygmy-falcon (*Polihierax insignis*) of Asia is quite separate from them. The latter species is not a sister taxon of the African species, and is even placed in a different clade. Because of these differences, an earlier generic name, *Neohierax*, may be applied to the Asian species. Lastly, the Brown Falcon of Australia and the New Zealand Falcon constitute departures in morphology or behaviour from the *Falco* norm. They are closely related to each other, although some phylogenetic schemes separate them. Their differences from other *Falco* are great enough that the name *Ieracidea* (or *Hieracidea*) has been applied to the Brown Falcon and *Nesierax* to the New Zealand Falcon, or both species have been placed in *Ieracidea*. This issue certainly merits more study, but DNA-DNA hybridization data from both species indicate that there is no difference between them and other *Falco* species, so for the moment they are retained within *Falco*.

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Morphological Aspects

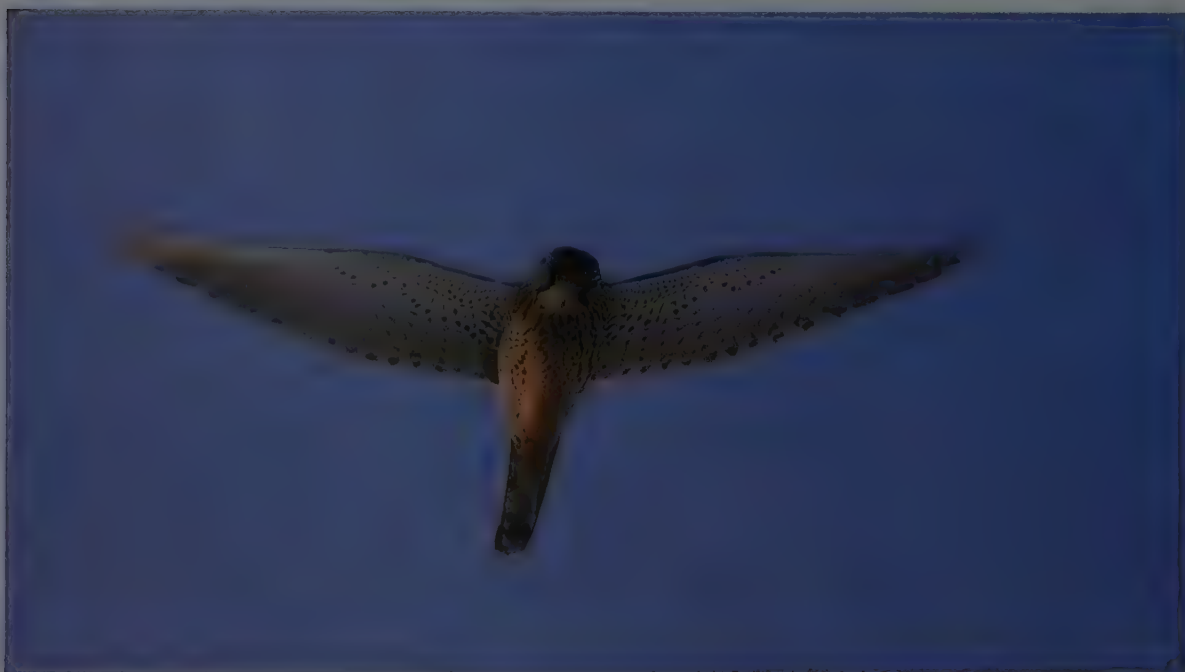
The popular image of the family is probably that of the typical falcons which have long pointed wings, strong hooked bills, sharp curved talons and great powers of flight and sight. Certainly, falconids are readily identified as birds of prey but perhaps not as easily distinguished from some of the hawks and kites of the family Accipitridae.

The smallest family members are the dashing Black-thighed Falconet (*Microhierax fringillarius*) and White-fronted Falconet (*Microhierax latifrons*), with a wing length of about 89-105 millimetres and weight sometimes as low as about 35 grams. The largest is the mighty Gyrfalcon, with an average wing length of about 369 mm for males and 406 mm for females, and average weights of about 1115 g and 1735 g respectively. Larger species and subspecies tend to be found nearer the poles, and there are greater numbers of smaller species closer to the equator.

The falconids have relatively small, light bodies with great power for their size. Ankylosed thoracic vertebrae make their bodies strong and rigid, and, except in the caracaras, the neck is short, making the birds appear blunt-headed in flight. Particularly in the faster fliers, the pectoral muscles are large and powerful; few measurements have been made, but those available show that the percentage of the total body weight taken up by these muscles ranges from 12% in kestrels to 20% in the Peregrine Falcon.

The *Microhierax* falconets are the smallest of all birds of prey. The Collared Falconet, for example, can measure as little as 15 cm in total length. Like the true falcons, these species have a "toothed" bill, but the body is relatively chunkier and the wings somewhat more rounded, in connection with a rather less active hunting technique.

[*Microhierax caerulescens*. Photo: Frank W. Lane/FLPA]



The falcons present a highly distinctive flight silhouette, with each wing tapering to a point. Tail length is more variable, and the species with the longest tails tend to be those that hover, such as the Common Kestrel. All members of the Falconidae are powerful fliers. They regularly use a dashing flight style that contrasts markedly with the seemingly rather relaxed soaring and gliding flight that typifies the medium-sized and large members of other raptor families.

[*Falco tinnunculus*. Photo: A. Limbrunner]

Whilst some falcons are ranked amongst the fastest fliers in the bird world, others are noted for their expertise in different aspects of flight, such as hovering. The Lanner Falcon does not often perform the spectacular stoops of some species, but it is a most versatile hunter, and as such is much prized by falconers. It tends to capture its prey after a very rapid pursuit flight, and is even known to attack prey that is flying towards it, a process that requires incredibly fast reflexes. The heavily streaked underparts of this bird indicate that it is an immature.

[*Falco biarmicus*.

Photo: Stephen Dalton/
NHPA]



Plumage in falconids consists of combinations of brown to chestnut, grey, black or white, often mottled, barred or streaked on the underside. Mostly, the feathers are waxy, but in a few caracaras, for instance the Black Caracara, they are glossy black with a green sheen. Tropical species tend to be more strikingly plumaged, as do species or forms from humid areas. For example, the Brown Falcon has several colour morphs which vary in prevalence from region to region, the species tending to be paler in more arid areas. Some forest-falcons have rufous and melanistic morphs.

The immature plumage of several species is distinct from that of the adult, though it is more distinctive in some species than in others. Immatures tend to be browner, with pale edges to their feathers, and have less bright or less strikingly patterned plumage than adults, generally with more streaking rather than barring. The plumage of the male tends to be somewhat bolder than that of the female in many species, and in a few species sexual dichromatism is marked. For example, in most kestrels the adult male is greyer than the female and immatures, and in *Polyborus* the adult female has a chestnut cape or crown, unlike the male and immatures. Falconids with distinctive adult plumage usually acquire it mainly during their first annual moult, beginning towards the end of their first year.

A few New World falconids have specialized plumage: forest-falcons have narrow, curved, stiff feathers that form a small ear ruff; some caracaras have the feathers of the occiput lengthened to form a flat crest (*Polyborus*), or curled to form a cap (*Phalcoboenus*), which is wavier in adults than in immatures; and the Laughing Falcon sports a bushy crest and collar.

Typically, falconids undergo a full moult annually, commencing during the breeding season. In the better studied species, the female drops her first flight-feathers soon after incubation commences, followed within a few weeks by the male, and both have dropped all their old remiges in about three (to four) months. The sequence of moult of flight-feathers is a characteristic of the family: flight-feathers are dropped sequentially, in pairs, beginning at the fourth primary from the inside and proceeding both inwards and outwards from this centre; moult of secondaries is also ascendent and descendent, and begins at secondary number five. The tail moult begins with the central pair of rectrices and proceeds outwards except for

the outermost rectrice (t6), which can be moulted anywhere between t1 and t5.

Apart from the caracaras, falconids have a shortened face, and most members of the family have brown eyes. With the exception of the white-eyed Greater Kestrel (*Falco rupicoloides*), all falcons and falconets have deep brown eyes. The eyes of caracaras are brown or hazel, and those of some forest-falcons are orange-brown. Generally, there is little age difference in eye colour, but in Black Caracaras the irides are brown in immatures and reddish brown in adults. The more crepuscular species, for example hobbies, have relatively large eyes.

Most species have bright yellow soft parts, comprising the orbital ring, cere and legs. However, in some these parts are grey, for example Black Falcons and most Brown Falcons, or orange, as in the Red-footed Falcon. In others they are grey in immatures, changing to yellow in adults, for instance in *Phalcoboenus* and some subspecies of the Peregrine Falcon. Their nostrils are oval, circular or slit-like (caracaras) and set in a fleshy cere. Some caracaras have unfeathered sides to the face, throat and crop, with brightly coloured bare skin. All members of *Falco*, except dark-cheeked species, have a dark malar stripe or stripes extending down from the anterior corner of the eye; these are thought to reduce glare reaching the eye.

Variations in the basic falconid form are closely linked to function, particularly to prey type, hunting habitat and hunting technique. For example, the robust bill of the Peregrine enables it to kill and dismantle relatively large prey, but with some loss of bill kinesis; it is less dextrous and has a smaller gape than the Brown Falcon, which has a narrower, less arched bill, eats smaller prey and swallows some prey whole. Short bills and jaw muscles modified to deliver a powerful bite, to kill and dismember prey, are typical of falcons and falconets. Some of the less predatory caracaras have relatively unhooked, weak, chicken-like bills, notably *Daptrius* and *Phalcoboenus*. By contrast, that of the Crested Caracara is large, laterally compressed and strongly hooked. *Herpetotheres* has a stout bill, rather like that of *Falco*, but it is untoothed.

Falcons' characteristic tomial teeth, projections on the cutting edge of the upper mandible with corresponding notches in the lower mandible, are thought to facilitate the killing of prey



At first sight, the caracaras do not look at all similar to the true falcons. The larger, bulkier body, the more rounded wings and the blunt, rather chunky bill combine to make these birds appear far less elegant, and their tendency towards terrestrial scavenging, as opposed to aerial predation, heightens the contrast. However, in the air the relationship between the two is apparent, due to their rather similar styles of flight.

[*Polyborus plancus plancus*, Falkland Islands. Photo: Annie Price/Survival]

and prevent slippage during dismantling; these are absent in the caracaras, Laughing Falcon and forest-falcons.

There are intraspecific and intersexual differences in bill morphology. For example, compared with many other subspecies, the Australian races of the Peregrine Falcon have a relatively large bill which may aid in the killing and dismantling of relatively stout-necked or difficult prey. Also, compared with males, female Peregrine Falcons have relatively larger bills.

A falconid grasps its prey using the talons of its sturdy hind toe and elongated middle toe. Mammal- or insect-catching species have fleshier, shorter toes, and a shorter middle toe, compared with falcons that more often catch birds. The talons are thin and only slightly curved in the terrestrial caracaras, sharp in *Daptrius*, and blunt in *Phalcoboenus* and *Polyborus*. They are highly curved and sharp in the other species, and can be quite massive, especially the hind "killer" talon of the larger *Falco* species. The length and thickness of the tarsus is also related to hunting mode. Peregrine and Black Falcons both have short, thick tarsi and hit relatively large prey with great force. More terrestrial species, such as kestrels and the Brown Falcon, have long legs and large, scute-like scales on the toes and tarsi. The Laughing Falcon has rough, hexagonal scales that are thought to withstand the bites of the venomous snakes on which it preys; bird-catching species tend to have fine, reticulate scales.

Falcons are renowned for their supposedly remarkable powers of sight. Head bobbing, while perched, is a typical falcon characteristic that makes the object of interest move in relation to the horizon and the background and thus aids in the perception of distance. Typically, falconids have two foveae, a nasally-placed monocular fovea which projects into the area of no visual overlap with the field of the other eye, and a temporally-placed binocular fovea. The Chimango Caracara (*Milvago chimango*) lacks the binocular fovea, perhaps because its scavenging habits reduce the need for detection and fixation of rapidly moving prey. However, the monofoveate condition may

prove to be primitive, rather than having a strong functional basis.

Falconids that hunt in dim light have relatively large eyes, for example pygmy-falcons, some hobbies, and the Brown Falcon. The diurnal and crepuscular Brown Falcon has been estimated to have about the same visual acuity as humans, the result of trade-off between resolving power and sensitivity, because of a need for resolution over a wide range of luminances. Falcons' supposed visual superiority over humans is thought to be primarily in the detection of movement rather than purely in exceptional acuity.

In general, falconids hunt from height and use mainly visual clues to locate prey. Thus it is not unexpected that they are unable to capture prey using auditory clues alone. In *Falco* species studied to date, the minimum audible angle (the angular margin of error in determining the direction of sound) is about 10°, compared with 1°-2° for their nocturnal counterparts, the owls. Although most species locate prey primarily by sight, some use sound on occasion, for example Brown Falcons, which listen and wait at the nest holes of passerines. More than any other falconids, forest-falcons use sound to locate prey; they have upward-curved ear feathers that form a slight ruff, designed for collecting sound, and also large asymmetric ear openings.

Falcons are credited with extraordinary powers of flight. The Peregrine is probably the fastest of all birds. It has a powerful direct flight with strong wingbeats and may reach 180km/h in a stoop; although greater speeds are claimed, there are no accurate estimates. Kestrels have been clocked flying steadily in light wind at 32 km/h; hobbies and falconets are energetic fliers and appear to reach high speeds over short distances. Caracaras tend to be slow, rather mechanical fliers.

While falcons are typically fast fliers, they also soar with ease, while some, particularly kestrels, regularly hover into the wind. Their wings are long and pointed, as are those of some



The Red-throated Caracara is one of the few falconids that occurs in dense forest. Indeed, it appears to be largely confined to areas of undisturbed forest, and, although also recorded in selectively logged forest, it does not appear able to adapt to heavily disturbed secondary growth.

[*Daptrius americanus*,
Costa Rica.
Photo: K. Wothe/
Bruce Coleman]

caracaras, with a low camber and quite high wing aspect ratio (length:breadth); these are essentially adaptations for life in open country, for powered flight, speed or hovering. The falconets have short, usually pointed wings and make brief flights to catch insects. The wings of forest-dwelling species, for example the Mauritius Kestrel (*Falco punctatus*) and the New Zealand Falcon, are shorter and quite rounded, particularly so in the forest-falcons and Laughing Falcon, allowing short, buoyant flight through the trees. Those falconids with greatest need for manoeuvrability tend to have relatively long tails. The forest-falcons, with short, rounded wings, a long tail, long legs and an ear ruff, superficially resemble an accipitrid, but the similarity is convergent, their forms reflecting similar lifestyles.

Most falconids are found in open habitats, ranging from savanna and steppe to desert and semi-desert. Like its three congeners, the Carunculated Caracara is a species of the temperate zone in South America. It occurs above the tree-line in the Andes of Ecuador and south-west Colombia, where it is one of the most conspicuous inhabitants of the páramo.

[*Phalcoboenus carunculatus*,
Cotopaxi, Ecuador.
Photo: D. Parer &
E. Parer-Cook/Ardea]



Thermal and wind currents are utilized by many falconids for foraging and display flights, and also for migration. A few species hover, notably most species of true kestrel, which hover into the prevailing breeze with ease; from this "aerial perch" the bird's body takes the buffets of the wind while its head remains stationary relative to any point of interest below.

The typical falconids have 10 functional primary remiges, with a vestigial eleventh, 11 secondary remiges, and 12 retrices. The Crested Caracara is said to differ, with its 10 primaries and 13-14 secondaries. Faster-flying falconids have tighter plumage, stiffer primaries and more pointed wings than slower species. The second outermost primary is usually the longest, but wing shape varies with lifestyle, particularly in relation to hunting habitat and technique. For example, the Brown Falcon of open woodland has long, broad wings, which are relatively rounded at the tip for a falcon; its wing formula is the same as that of the New Zealand Falcon, which has similarly shaped, but shorter, wings for life amongst denser vegetation.

Longer-legged falconids can walk or run along the ground, or the branches of trees, with ease. Some scratch at, or stamp on, the soil to disturb invertebrates or worms; this is typical of several caracaras, but also occurs, occasionally, in a few falcons. Most falcons, however, are rather short-legged and slightly awkward on the ground, although they can lean forward and run surprisingly fast. Rarely, a falcon may be pulled into the water during an attack on prey, but it is usually able to "row" overarm, with its wings, to the shore.

Habitat

Falconids are found throughout the world, with the exception of the Antarctic and the high Arctic. They occur in most habitats from rain forest to desert, from wilderness to city centre. Although members of the family are encountered in nearly every climatic zone, the greatest number of species is found close to the tropics and only two species breed far north in the Arctic tundra. Diversity also tends to be poorest at high altitudes, and richest in lowlands.

Because the structure of the habitat is more important to them than any particular plant types, most falconids are quite adaptable. Nevertheless, several species have quite specific nest-site requirements, and so are limited by habitat suitable for breeding. For example, many species need tree cavities, and colonially nesting Eleonora's Falcons prefer remote islets and rocky sea cliffs pocked with hundreds of sheltered holes and ledges.



Long periods are spent preening. Diligent feather care is essential, because the condition of the plumage obviously has most important effects on flight performance and hunting success, and ultimately on the bird's long-term survival. Some species have been recorded allopreening, whereby partners preen each other; this probably serves mainly to strengthen the pair-bond. Other common forms of comfort behaviour include bathing in water and dust-bathing.

[*Falco vespertinus*.
Photo: P. Bracht]

Most falconids have a fairly wide distribution, but, with notable exceptions, typically occur at fairly low densities with somewhat scattered distribution. Nevertheless, certain species may be the most successful of raptors. For instance, the Common Kestrel (*Falco tinnunculus*) breeds over large areas of Eurasia and Africa, in a wide variety of habitats and under a number of climatic conditions, and it is often common. In Australia, Australian Kestrels (*Falco cenchroides*) and Brown Falcons occur almost throughout the continent, and during a national survey these two falconids were the most widely encountered of any bird species. The cosmopolitan Peregrine Falcon may have the widest breeding distribution of any bird. At the other extreme are falconids greatly restricted in distribution or numbers: the naturally rare Taita Falcon (*Falco fasciinucha*) is found only in dry country at scattered gorges and mountainous locations in East and Central Africa; Eleonora's Falcon breeds in fewer than 100 more or less dense nest colonies almost all in the Mediterranean; the semi-deserts of northern Argentina are the very limited range of the Spot-winged Falconet; and the highly endangered Mauritius Kestrel is found only on the isolated island of Mauritius, where it has been driven to the brink of extinction by destruction of its forest habitat.

Typically, the falconids are thought of as birds of open country. Most of the falcons and caracaras conform to this

image, and frequent open or semi-open areas, normally of woodland or scrub. Even the forest-dwelling falconets and Bat Falcon are found near forest edges and clearings, and New Zealand Falcons favour broken forest. As a group, the forest-falcons may be the most dependent on continuous forested habitat. Other forest species, for example the Black and Red-throated Caracaras, although able to survive in semi-cleared areas, apparently are less successful there than in undisturbed habitat.

Fifteen species occur exclusively in Central and South America, including all the species of caracara and forest-falcon, the Spot-winged Falconet and two members of *Falco*. Only the Prairie Falcon is exclusive to North America, and a further two falcons, the American Kestrel (*Falco sparverius*) and the Aplomado Falcon, are found only in the Americas. Six of the seven species of falconet are found in Asia. Six *Falco*, five of which are kestrels, are confined to islands or island groups where they are often the sole falconid species. Seven *Falco* are Eurasian, with two extending to Africa and one to North America. Six *Falco* are solely Australasian in distribution and another six are restricted to Africa. A further five falcons have a breeding distribution that includes Africa, and seven more species winter on that continent.

According to the categorization developed by L. H. Brown, there are twelve main raptor habitats, each with its own typical



Many falconids are fairly vocal, and this is particularly true of the caracaras and the suitably named Laughing Falcon (*Herpetotheres cachinnans*). The caracaras of the genera *Phalcoboenus* and *Polyborus*, and to a lesser degree *Milvago*, have loud, normally rather raucous calls, which are used for proclaiming occupation of a territory. When calling, these birds adopt a characteristic posture, with the head thrown right back, as illustrated by this Striated Caracara.

[*Phalcoboenus australis*.
Photo: Fritz Polking/FLPA]



The Prairie Falcon feeds mainly on fairly small mammals and birds, and amongst the former ground squirrels are particularly favoured, as in this case. This species usually forages by flying along at medium height, diving in a fairly shallow stoop at prey. It typically captures a great deal of its prey, including birds, either on or close to the ground.

[*Falco mexicanus*, Idaho, USA.
Photo: Erwin & Peggy Bauer/Bruce Coleman]

mix of falconids. In the four richest habitats: about 30 species breed regularly in tropical savannas; and around 20 species each in temperate to subtropical steppe and grassland, subtropical semi-arid woodlands and mountains, and tropical forests. Temperate moorlands and mountains provide regular breeding habitat for 10 species, and deserts and semi-deserts for 12 or so species. The Gyrfalcon and the Peregrine Falcon breed in the northern tundra and are joined by the Merlin (*Falco columbarius*) in the taiga. Another three habitats are frequented by two to three species each: aquatic (coastal) habitats by Eleonora's and the Sooty Falcons; tropical montane moorlands and mountains by Peregrine and Lanner Falcons and the Mountain Caracara; and temperate deciduous woodlands by the White-throated Caracara and the Eurasian Hobby. Lastly, at least 15 species find that the establishment of cities creates breeding sites and attracts a regular supply of prey.

After breeding, many species shift to a different habitat. Resident species may make a local movement to an area with more abundant food than is found around the nest-site. For example, some Australian Peregrines shift with their fledglings from sub-coastal cliffs (some over temperate forest) a short distance to coastal lowlands, over farmlands and towns. Migrants may make more drastic changes in habitat. A good example is Eleonora's Falcon, which breeds in barren parts of the Mediterranean and nearby Atlantic coasts, and migrates to the humid forests and woodlands of Madagascar. Nevertheless, migrants are often found in habitats that are structurally similar to that in which they bred. Gyrfalcons breed in Arctic areas mainly above the tree-line, and migrate south to winter in moorland, steppe and other open areas with low vegetation.

Sometimes the sexes winter in different habitats: female American Kestrels tend to winter in more open country than do males. The immatures of many falconids may frequent habitats that are not well used by adults; often those with ample prey and suitable hunting habitat, but which are unsuitable for nesting.

General Habits

Typically, falconids are thought of as solitary predators that co-operate with conspecifics only to reproduce. Although most

species do live alone or as solitary pairs, it may come as a surprise that several species are highly gregarious. These social species tend to lead less predatory lifestyles than typical members of the family: Red-throated Caracaras forage in the forest for wasp nests; and Lesser Kestrels (*Falco naumanni*) specialize on insect swarms. Red-throated Caracaras may be unique among raptors. About six birds, in a group, defend a territory all year round and forage together through the forest, each member searching independently, as many pairs of eyes are better than one. Group cohesion is maintained by means of loud contact calls, sharing of large prey items and allofeeding, which involves one bird feeding another. Lesser Kestrels live in flocks, and, although each member appears to operate independently when hunting, some advantage may be gained through disruption of the insect swarms on which the birds prey.

Even the most predatory of species, for example some of the larger falcons, hunt in co-operative pairs at times and share prey. Fledglings are usually more gregarious than adults, and move in sibling groups, in family groups or occasionally with unrelated birds; they hunt and roost together. Even adults of some species may congregate in loose single- or mixed-species flocks, where food is temporarily plentiful. In Australia, occasional outbreaks of the house mouse (*Mus musculus*) may attract large gatherings of Brown Falcons and Australian Kestrels, sometimes peppered with Black Falcons and other raptors, all hunting independently. In a mixed-species foraging guild, other frugivorous species of bird join Red-throated Caracara groups to forage in the forest understorey, where they rarely venture otherwise. The Caracaras' efficient anti-predator warning and mobbing behaviour probably protects the whole foraging group.

Territoriality is typical for most falconids, which depend on prey that is at least seasonally predictable and reasonably widely available. Species that specialize on patchy or ephemeral prey tend to live in groups, as individual defence of such resources would be impractical and individual searching less likely to be successful than a joint effort.

Raptor pairs space themselves apart, particularly from conspecifics, and even those of colonial species defend a small area: a few square metres for pairs of Eleonora's Falcons; less

The Lesser Kestrel is a noted specialist on insects, which often make up over 90% of its prey. Crickets are very commonly taken, as are grasshoppers, locusts and beetles, while termites and ants are important in its African winter quarters. The widespread and often indiscriminate use of pesticides has caused a major decline of this species, mainly as a result of poisoning and reductions in the populations of its prey species.

[*Falco naumanni*.

Photo: José Luis Rodríguez/
Nature & Travel]



than 1 km² for each American Kestrel pair; and as much as 1000 km² for each Gyrfalcon. Groups of Red-throated Caracaras defend a shared territory all year round, but only one pair breeds. For some species the territory is permanent, for others it is occupied and defended only during the breeding season. Some territories with traditional nesting and roosting sites are occupied by successive pairs of raptors for centuries. Non-resident species, for example the American Kestrel, may defend winter territories.

Defence is not only against conspecifics but also against predators and other aggressive species. Colonial nesters and foragers perform collective defence against potential predators. For example, Eleonora's Falcons take to the air *en masse* to defend the colony area against potential predators, such as eagles, but on the ground they behave like solitary nesters, although with a markedly smaller space per individual. In a communal territorial display during the breeding season, between morning and evening feeding periods, adult Amur Falcons gather and soar in noisy, chattering flocks, gradually descending to fly in formation in a wave-like pattern just above the ground, and turning sharply in unison to flash their wings. Conspicuous, sometimes spectacular, aerobatics seem to serve as territorial displays for many species, but they are not often seen outside the breeding season. Forest-dwellers often rely on calls to advertise territoriality.

Some species hunt, nest and roost together year round. The Lesser Kestrel uses traditional roosts on migration, some in city centres, with up to 70,000 noisy birds crowded into a patch of eucalypts. Before roosting, they gather in wheeling flocks around dusk, and after dawn they leave in smaller groups to forage on the wing most of the day. Similarly, Amur Falcons number up to 5000 at favoured roosts, with as many as 100 in a tree. Other species, such as the Eurasian Hobby, flock on migration and roost gregariously with other small falcons, but disperse to individual territories on returning to their breeding grounds. Many falconids become more gregarious outside the breeding season. It has only been fairly recently that the communal roosting habits of Peregrine Falcons have been reported. Each autumn up to nine Peregrines, five Common Kestrels, six accipitrids and 17 corvids roost together in British conifer woodland surrounded by open country, and up to five adult

Peregrines have been seen sharing a traditional autumn roost in Czechoslovakia; around sunrise, the birds disperse to different feeding areas. The function of communal roosts is hotly debated. They are suggested to serve as centres for exchange of information about local prey, for protection, for thermoregulation or for social purposes, but none of these proposals has been investigated in falconids. On occasions, pairs and family groups of diminutive pygmy-falcons (*Polihierax*) huddle together at a roost, for warmth in the cold desert night.

Solitary species also use traditional roosts, as well as temporary ones. They are usually at sites sheltered from the prevailing weather, the heat of the day and so forth. Roost-sites can be quite varied, for instance the Red-necked Falcon (*Falco chicquera*) roosts in *Borassus* palms, pygmy-falcons roost in weaver nests, many species roost in clumps of *Eucalyptus*, and some caracaras roost on the ground.

Typically, falconids are active by day. Many leave their roosts around dawn to forage; on rainy or overcast days they delay their departure. In hotter climes, some species roost during the heat of the day. Eurasian Hobbies and Bat Falcons may roost by day and hunt moths and bats crepuscularly. Red-throated Caracaras are active from before sunrise to after sunset, with a rest of one to three hours at a roost around midday. They rest during heavy rain, but continue their foraging during showers, averaging about ten hours of activity per day, with little day to day variation. Several species normally active by day occasionally hunt nocturnally. For example, Australian and Common Kestrels have been observed hunting by moonlight, and Australian Peregrine Falcons catch petrels as they return to their burrows well after nightfall. Where several species occur in the same habitat they usually have different habits, including different activity patterns, that serve to separate them in space and time.

In common with most birds, falconids spend considerable time on feather maintenance. They have well developed oil glands, and many species bathe in water, others in dust (usually desert species). The aerial hobbies may "bathe" by flying through wet foliage. Many species also sunbathe, back to the sun, with the wings outstretched, although this may be for warmth as much as for feather care. Preening does not follow a sequence, but rather it seems to be carried out according to



need. Australian Kestrels spend about one third of their preening time, scattered throughout the day, on the wings, one fifth on the underparts, and one tenth each on the head, tail and back. Pairs of a very few species allopreen, for example occasionally a Brown Falcon will gently groom the cheek feathers of its mate, presumably to help maintain the pair-bond.

In many sexually dichromatic raptors the plumage of immatures of both sexes resembles that of the adult female. At least for the Common Kestrel, evidence suggests that in young males this serves to reduce competition with adult males by deception, through mimicry of females, rather than by signalling low status due to immaturity.

Other plumage differences may also function as social signals, for example the pronounced facial pattern of the Bat Falcon may serve as a territorial signal: a bird will perch prominently above the forest canopy and puff out its cheek and neck feathers. Similarly, to the human eye, the pale bib of a Peregrine Falcon is visible for some distance, particularly when the crop is full. In the caracaras, a bright face and a bright crop serve

as social signals. For example, the face of the Crested Caracara changes from orange to bright yellow in excitement. The bare crop in these species, so obviously displayed when full, may serve as a cue in scuffles over food, or to advertise hunting prowess to potential partners. Bright soft parts on any species may signal the good health of that individual, perhaps an aid to sexual selection. Another unusual feature of the caracara group, unprecedented among birds, is the ability of the Red-throated Caracara to emit a powerful insect repellent so that when the birds plunder insect nests the angry wasps and bees depart instead of attacking.

Voice

One of the distinguishing characteristics of the Falconidae is the structure of their syrinx, the organ of voice production. Thus it is not unexpected that members of this family have calls of different quality to those of other diurnal raptors belonging to the Accipitridae. Nevertheless, members of both families have rather unspecialized, simple calls.

Most falconid vocalizations consist of repeated monosyllables, varied in pitch and frequency of repetition to suit different situations. Both sexes use a similar range of calls, but the pitch is usually consistent with the bird's size, so that those of males are somewhat shriller. Falconids' voices tend to be rather harsh or strident, described by such terms as cackle, chatter or chitter, squawk, croak, wail and whine. The call of the Collared Forest-falcon (*Micrastur semitorquatus*) is said to sound like a person groaning in pain!

The birds' calls cover a variety of functions, including most social situations, threats, alarm, courtship, begging and so on. Group cohesion is probably the main function of the continual calling emitted by members of noisy groups of Red-throated Caracaras as they forage closely, but independently, through the forest. Similarly, Lined Forest-falcon pairs call to each other as they travel through the forest.

It is suggested that some forest-falcons use a certain call, which carries little directional information about the caller, to attract small birds on which they prey. The birds arrive to mob the calling, concealed predator, but are unable to discern its location, and thus are vulnerable to attack (see Food and Feeding).

Mostly before sunrise, pairs of all forest-falcon species duet in a brief, sonorous dawn chorus, which arguably qualifies as true song, although both sexes contribute. Laughing Falcon pairs often duet in the twilight as well as around dusk. Perched within metres of each other, they assume an erect posture and sing two far-carrying notes over and over again, the two birds varying the timing and pitch to produce a full, smooth, unhawk-like sound; the laugh-like call for which they are named is uttered when they are disturbed. As with most birds species, falconids that duet are tropical species frequenting dense vegetation, most likely with high mate and territory fidelity.

Forest-dwelling species are probably the most vocal, in order to maintain bonds in dense vegetation, whereas most falconids live in more open country, solitarily or as scattered pairs, and would have less need for contact calls or for song. Indeed, most species are fairly silent except during the breeding season when they make excited courtship calls and engage in spirited, raucous defence of the nest area. Colonies of Lesser Kestrels, Eleonora's Falcon, Red-footed Falcons and Amur Falcons are noisy places of low, chattering, sexual excitement interspersed with higher-pitched screeches. Resident species sometimes continue to defend the nest-site all year round. For example, at any time of year, if present, Orange-breasted and Bat Falcons are very vocal when their nest-sites are approached.

The caracaras are the only falconids with an onomatopoeic name, probably referring to the chattering, rattling call of the Crested Caracara. The Spot-winged Falconet and the forest-falcons also make loud, guttural calls or nasal, barking calls. Vocalizations are often associated with gestures. For instance,

Although it has been said to prey extensively on insects and rodents, the Aplomado Falcon is now known to feed mostly on birds. Members of a pair will frequently hunt in tandem, which can involve one of the birds moving into cover in order to flush prey out, so that the waiting partner can pounce on it. Research has shown that, when attempting to catch avian prey, pairs operating in tandem are more than twice as successful as solitary individuals.

[*Falco femoralis femoralis*,
Tierra del Fuego.
Photo: Günter Ziesler]



Once prey has been caught, it is often taken to a favoured perch to be eaten; birds are carefully plucked prior to consumption. The Eurasian Hobby is one of the most aerial of predators, feeding extensively on insects, but also on small birds, especially during the breeding season when fledglings of small passerines abound. This species regularly dismembers and eats insect prey while on the wing.

[*Falco subbuteo*.
Photo: Stephen Dalton/
NHPA]

when Black and Red-throated Caracaras utter calls likened to forced laughter, this is accompanied by nodding of the head. The members of *Polyborus* and *Phalcoboenus* throw the head back, often until it touches the shoulders, when they make their raucous territorial calls. At the nest they make short clicks, and grumbles when disturbed. For obvious reasons, the softer calls, made in more intimate situations, are less well known than the louder defensive or advertising calls.

It is not always possible to distinguish species by their calls. For example, the calls of the various different forest-falcon species are rather similar, as are those of several kestrel species. In fact all the falcons and falconets have very similar calls, based mainly on a multi-purpose "kek" or "kik", and their calls differ chiefly in that they are higher-pitched in the smaller species. In each species the basic call is adapted to a range of situations by varying its pitch, the number of repetitions, the frequency of repetition and so forth. The Australasian Brown Falcon may be the exception. As well as typical falcon calls, it makes a variety of atypical chatters, squawks, chuckles and clucks, some seemingly caracara-like, and it tends to be rather vocal.

Older nestlings call insistently when hungry or uncomfortable, including yelps in *Milvago*, and whines and wails in *Falco*. Adult females often use similar calls to solicit food from males. In *Falco*, at least, these are combined with a submissive, hunched posture or fluttering flight, as used by a soliciting fledgling.

Unlike the accipitrids, falconids sometimes hiss defensively when cornered, a form of behaviour that has occasionally been claimed to ally them to the owls.

Food and Feeding

Falconids usually evoke images of fast-flying, highly effective predators that catch birds on the wing, and, in fact, most large members of *Falco* and some falconets do so. Some tiny

family members, the dashing falconets of the genus *Microhierax*, catch large flying insects rather than birds in the air. There are others, however, primarily Neotropical caracaras, that walk on the ground, scratching the earth and scavenging. Some authors loosely clump falconids into two categories of hunters, the searchers and the attackers. Searchers spend considerable time searching, and usually hunt small, abundant prey that is relatively easy to catch. They usually have a high success rate. Attackers, on the other hand, put more effort into the actual capture, and usually hunt larger, less numerous and more agile prey types. They have lower success rates. Some searchers have relatively narrow wings and long tails, with light wing-loading, such as the Chimango Caracara. Others, like Crested Caracaras, have broader, more buzzard-like wings. Typical attackers, such as the African Hobby, have long, narrow wings with short tails. Some attackers that hunt in forests, like the Mauritius Kestrel and the New Zealand Falcon have wing and tail proportions somewhat like forest hawks, most notably in the case of the Collared Forest-falcon and its congeners.

Diet and foraging manner change somewhat from genus to genus within the family, and even considerably within true falcons. The diurnal schedule of hunting and also success rates vary considerably between groups and even within a single species. Although it is most informative to treat feeding by group, there are some interesting habits that are rather widespread within the family.

Kleptoparasitism is the stealing of food from another animal, in this case usually from a bird. The Crested Caracara is an accomplished kleptoparasite, taking food from other raptors, gulls and pelicans. The Aplomado Falcon steals from harriers (*Circus*) and kites (*Elanus*), and sometimes several falcons will even gang up on another raptor to take its food, a sort of social robbery. The list of falcons that are kleptoparasites is lengthy, and includes Common and Lesser Kestrels, the Merlin, the Eurasian Hobby, and Red-footed, Brown, Black, Lanner, Prairie and Peregrine Falcons. The Black Falcon even takes



Reptiles are taken by many falconid species, although they are not often the main source of food. The Australian Kestrel takes a fair variety of prey types, amongst which reptiles, especially skinks, are particularly important during the breeding season.

[*Falco cenchroides*, Australia.
Photo: Hans & Judy Beste/Ardea]

food from the Peregrine Falcon that is much faster, though smaller, than itself.

Caching, the putting away of food for later use, is another habit that, within *Falco* at least, is quite common. Such caches can be useful when hunting is made difficult during bad weather, and in Britain, for example, 39% of the food fed to young Peregrines at one eyrie was from a food cache. Caching occurs throughout the year and has been recorded in at least 21 species of falcons, ranging from the largest, the Gyrfalcon, to one of the smallest of the kestrels, the American Kestrel. It has accordingly occurred with species living in all habitats, from Arctic through temperate to tropical. It will probably be found to occur with most if not all falcon species. In Canada, a female Merlin was seen to cache food and immediately return to the business of hunting for other food, suggesting that she was hunting in the absence of immediate food needs. Another Merlin in Wyoming in mid-winter was seen to catch two House Sparrows (*Passer domesticus*) in succession and cache both of them, before flying off elsewhere to perch and loaf. A Peregrine Falcon, that had just eaten, cached the next two prey items caught; apparently hunting to cache rather than in response to hunger. A Gyrfalcon, feeding on a frozen ptarmigan (*Lagopus*) that had been retrieved from a cache in mid-winter in Alaska, seemed to be "shaving off" thin slivers from the frozen body with each bite. During the breeding season, the cache is usually not too far distant from the eyrie; the female can take a break from incubation, fly to the cache, and begin feeding, usually in less than a minute. In nearly all seasons, most caches are to be found in conspicuous locations, such as prominent clumps of grass in a field, unused nests or other obvious locations in trees, or conspicuous ledges or nooks on cliffs and buildings.

During the breeding season, even starting as early as the courtship period, the female falcon, in most species, is dependent on the male to provide food. In many species, nestlings are provisioned by the male for at least the first half of their nest life, after which time the female begins to hunt for food. Some falcons are principally insectivorous, but feed mainly mammals or birds to their nestlings, and the proportion of vertebrates increases as the young grow. Some species, such as Eleonora's Falcon, feed primarily on birds during breeding, but on insects during migration and on their non-breeding, wintering grounds.

Food requirements vary considerably depending on a bird's age, size, and activity, and also on the season. For example, an adult Peregrine Falcon in north temperate latitudes, requires about 15% of its body weight in winter and 11% in summer. Averaged for a year, a male Peregrine requires about 113 grams of food per day, a female roughly 141 grams. Soon after hatching, nestling Peregrines ate 80 grams per day; their peak food intake was at 33 days old, when each ate about 300 grams per day. Since the falcon wastes about 20%, by weight, of the kill, in feathers, bones and items not picked clean, on average it would take a total of about 22.4 kilograms a year for a pair of adults to raise a family of 2.5 young. In Australia, from the moment of hatching to that of fledging, young Peregrines each ate approximately 4000 grams of food.

While caracaras only make up about 7% of the falconid species, their food and feeding habits incorporate a spectrum and breadth perhaps exceeding the rest of the family. About the only thing they do not do with ease, nor frequently, is catch birds or insects on the wing. Much of the variety of their food fare arises because, in addition to killing food, they are omnivorous, and, for instance, regularly take carrion, even feeding in garbage dumps on discarded human waste, flies and other insects. The Crested Caracara and the Striated Caracara (*Phalacrocorax australis*) kill prey as large as lambs. The Crested Caracara adroitly takes nestling birds from nests, and in northern Mexico has been seen attempting to catch flying Cattle Egrets (*Bubulcus ibis*). In Argentina this species was seen to catch a domestic pigeon in flight. In Peru, when feeding at carrion, it clearly had the lowest rank in a dominance hierarchy with vultures and condors, arriving at the carcass after the vultures had gone, or prior to their morning arrival. Food of the Carunculated Caracara, of the high barren mountains of Ecuador, varies considerably from one mountain to another just 30 kilometres distant: earthworms made up 50% of the biomass at one location, but only 1.5% at the other; amphibians, lizards and other reptiles made up 62% of the biomass at one site, but only 1% at the other; other frequently eaten food items were beetle larvae, as large as a human thumb, and centipedes. On occasions, an adult Mountain Caracara will regurgitate a bolus of food, containing wheat, maggots and vegetable matter, for its young. In specific areas where local people engage in trap-



Caracaras regularly feed on carrion, and thus perform a similar role to vultures in disposing of rotting flesh and avoiding the spread of diseases. Inevitably, they also feed on the carcasses of domestic livestock, and this sometimes leads them into conflict with farmers, who accuse them of killing sheep. A dispute has broken out for dominance at this carcass between the two adults, as the duller, browner juveniles look on.

[*Polyborus plancus plancus*,
Santa Cruz, Argentina.
Photo: Günter Ziesler]

ping mammals, such as foxes, Mountain Caracaras are frequently seen with missing feet or toes. Locals concluded that perhaps the caracaras tried to take bait from their traps and were injured in the process. In the Falkland Islands, the Striated Caracara visits seabird colonies, especially those of penguins, to steal nestlings. The small *Milvago* caracaras frequent agricultural lands, and the Chimango Caracara follows ploughs, much in the manner of gulls, in order to glean worms, insects and other invertebrates that may be uncovered. The food fare of the Chimango is so extensive that it fills the roles of falcon, vulture, insectivore and herbivore. The Argentine observer Azara said that "all methods of subsistence are known to this bird; it pries into, understands, and takes advantage of everything." This description applies well to the Chimango: it has been seen trying to eat leather from discarded, crusty shoes; flying through fires on the *pampas* grabbing fleeing insects, mammals or birds; stealing nestling birds from concealed, domed ovenbird nests; and wading knee-deep in drying up pools looking for frogs, tadpoles and other aquatic prey. Charles Darwin watched it trying to pick flesh from saddle sores on the backs of horses. The Yellow-headed Caracara (*Milvago chimachima*) will take ticks from the backs of cattle, and eat eggs, fruit of oil palms, grain and horse dung. The deep forest caracaras (*Daptrius*) eat large numbers of wasps and a good deal of fruit. Red-throated Caracaras participate in food sharing and deliberately allofeed, which contributes to their social cohesion (see General Habits). In the mature primary forests in which they apparently evolved, they forage frequently in the understorey, where they have much higher success rates than do conspecifics foraging in secondary or disturbed forests.

The falconets comprise three distinctive and geographically disjunct genera: the Spot-winged Falconet of South America; the African and White-rumped Pygmy-falcons, of Africa and south-east Asia respectively; and the five species of "true" falconets (*Microhierax*) that range from India to the Philippines. The hunting habitat of the Spot-winged Falconet and the pygmy-falcons is similar, consisting of chaparral, open thorn-scrub and savanna, while that of the true falconets varies from deep forest to open forest along edges and clearings, frequently in agricultural areas. The five species of *Microhierax* hunt much like flycatchers, wood-swallows (*Artamus*) or

shrikes (*Lanius*), from a perch on a dead exposed branch, from which the bird makes rapid dashes at insects, the occasional bird, or lizards. They are birds with slightly rounded wings and high wing-loading, "hit-or-miss" attackers that never chase prey once it has been missed. H. Miranda describes the attack as usually proceeding with a relatively oblique flight on a downward slope of 30° or so. When prey is missed, the bird circles round and returns to an exposed perch, frequently the same one from which it launched forth. In India, small parties of Collared Falconets (*Microhierax caeruleus*) often launch out at prey from a huddle, one by one or several together, and, if the prey is missed, they circle back to the same perch to huddle again and wait for the next butterfly or flying insect to pass. A butterfly chase by the falconet is strongly reminiscent of the twirls and turns of the Merlin when pursuing a fast-flying songbird. Although these birds inhabit forests and especially forest edge, their hunting methods more clearly resemble those of typical falcons than those of forest hawks. This falcon-like hunting is reflected in the shape of the wing: while somewhat rounded, it is not nearly as reminiscent of the wings of *Accipiter*, as is the wing of the forest-hunting Mauritius Kestrel. Of 328 attacks by Philippine Falconets (*Microhierax erythrogenys*), 63% were successful with 70% of the prey being dragonflies, and 24% bees and butterflies. Birds as large as robins (*Erithacus*) and pipits (*Anthus*) are attacked. The most intense hunting in the Philippines took place in the morning, until about 10:00 hours, which coincided with peak activity of insects.

The African Pygmy-falcon also mainly takes large insects but it catches many more lizards and birds. While about 73% of a sample of regurgitated pellets contained insects, 37% also contained lizard remains, and 15% contained bits of birds and mammals. Birds as large as a Sociable Weaver (*Philetairus socius*), with which the species associates for breeding, have been caught on the wing; the weaver weighs about 35-45% of the falcon's weight. Pygmy-falcons often "hawk" their food from a perch, like a shrike (*Lanius*), but they do not hover like hunting kestrels.

The Spot-winged Falconet, the American counterpart of the African Pygmy-falcon, has been the subject of far less research to date. Its food consists of insects, arthropods and birds, but

its hunting techniques are not well documented. When hunting, it has been seen to fly from perch to perch with a low flight, fairly close to the ground, again much like a shrike as it swoops upward to the perch. An adult Monk Parakeet (*Myiopsitta monachus*), a species nearly equal in size to the falconet, is among the food fare recorded. Because the falconet frequently nests in parakeet colonies, perhaps an adult parakeet was unexpectedly caught while in its nest.

Laughing Falcons are snake specialists, the ecological equivalent in diet to the snake-eagles of Africa; the species might more appropriately have been named "Snake Falcon". Well over 90% of its diet is made up by snakes. In primary forest in Guatemala, 22 species of snakes are known in the diet; the percentage of arboreal to terrestrial snakes may change from year to year, with arboreal snakes more numerous, comprising up to 75% of all snakes taken. In modified habitats and near agricultural lands, the percentage of terrestrial snakes increases to 70%, and other reptiles, amphibians and an occasional bird are taken. A capture success rate has been given at 30%. A Laughing Falcon, in a crouched posture with its wings outspread, was seen walk up to a snake on the ground before catching and killing it. Snakes may be killed at the time of capture or brought to the nest alive; some, but not all, venomous snakes have their heads removed.

Diet among forest-falcons varies from species to species, with the percentage of different food types perhaps less important than the biomass they provide. R. Thorstrom reported that the diet of Barred Forest-falcons in Guatemala consisted of about 42% reptiles and 15% birds, while in the larger, perhaps more terrestrial, Collared Forest-falcon 35% of the food taken was made up of mammals, 27% of birds and 14% of reptiles. Birds as large as chachalacas (*Ortalis*), Keel-billed Toucans (*Ramphastos sulfuratus*) and aracaris (*Pteroglossus*) were caught. Barred Forest-falcons used various foraging techniques, including perch-hunting, nest robbing and still-hunting around ant swarms. This last technique consists of following army ants and capturing organisms that are flushed by the ants. At least two species use army ants as flushers, and it seems quite likely that all six species do so. Sometimes forest-falcons shake bran-

ches with their feet to flush prey. The Collared Forest-falcon has been seen on the ground running after prey, chachalacas in Guatemala and rabbits in Argentina. Perhaps the most unusual hunting technique of this group is the provoked mobbing of calling Slaty-backed Forest-falcons (*Micrastur mirandollei*) by small birds. Calls of the concealed forest-falcon attract birds within range, close enough for them to be caught. Apparently this works best on naive and inquisitive North American migrants that have no previous experience with the forest-falcon.

True falcons forage using an array of methods that are reflected in some anatomical adaptations. Grabbing prey in the air is facilitated by long toes, and an index of the feeding manner is reflected in the toe to tarsus ratios. Aerial bird specialists, such as the Peregrine Falcon and Orange-breasted Falcon, have long toes that are about 98% as long as the tarsi. The success rate of these species varies considerably, depending somewhat on the season and also on special circumstances. On migration, Peregrines have success rates reportedly as low as 7.5%. One unique male, in an area with abundant food in New Jersey, USA, had a reported success rate of 93% during the breeding season. A single hunting sortie in Peregrines can require as little as two minutes or as much as three hours, from the moment of leaving the perch through that of prey capture till that of returning to the perch. A male Peregrine in the Alaskan tundra was followed by helicopter, at sufficient distance not to cause the falcon any concern. On one hunt, he was followed for one hour, 20 minutes, during which time he made eleven stoops before catching prey. On another hunt, he travelled less than 30 m above the ground for 22 minutes, and achieved speeds of 112 km/h and 160 km/h in stoops. On yet another occasion, 23 minutes elapsed from his leaving the eyrie and returning with prey, which he caught on his second stoop.

With falcons generally, the time required for catching prey is related to: the age of the falcon; its experience and hunger level; prey density; the proximity and vulnerability of prey; time of day; and weather factors. Aerial insect- and bird-eating species, such as Sooty and Eleonora's Falcons and the Eurasian Hobby, are smaller than the aerial bird specialists and have relatively shorter toes, equivalent to 91% of the tarsi.

Caracaras are adaptable omnivores that are able to take advantage of whatever food source presents itself, and they often associate with man. The Mountain Caracara, for example, can regularly be seen at rubbish dumps, where it searches, mainly on foot, for scraps of carrion and waste, as well as small rodents and insects. This bird was feeding on excrements.

[*Phalcoboenus megalopterus*, Lake Poopó, Bolivia. Photo: X. Ferrer & A de Sostoa]



The Common Kestrel is an extremely efficient hunter, as is amply demonstrated by its abundance throughout much of its range, most notably in the heavily transformed habitats of Western Europe. Small mammals, such as voles and mice, can make up 90% of its prey, and these are often caught from hovering flight: the bird waits for the right moment, before swooping swiftly down on its prey. One of this bird's primaries has come adrift during this attack, but the kestrel has caught its mouse just the same.

[*Falco tinnunculus*,
Photo: A. Limbrunner]



Eleonora's Falcons sometimes pursue prey in groups, and J. Parrish and L. Clark recorded success rates of 71% thus, as compared with 68% for birds hunting singly. A pair of Bat Falcons caught 15 swallows in six hours. Ground-hunting kestrels, such as the Lesser and American Kestrels, have still shorter toes, equivalent to 65% of the tarsus. Their success rates vary somewhat, depending on whether or not they are perch-hunting, and whether they are feeding on insects or mammals. From a perch, success rate in American Kestrels is about 52%, but when they are hovering it is only about 14%; success rate on invertebrates is 85%, but on vertebrates only 23%. Lesser Kestrels are opportunistic feeders, and during the non-breeding season, when they are in Africa, they frequently hunt in small parties or large, disorganized groups. When insects are swarming, they hunt in flocks mixed with Red-footed Falcons and Eurasian Hobbies. They are particularly drawn to grass fires where insects are fleeing, and to areas where flying termites are emerging.

Ground-hunting generalists, such as the Brown Falcon, have long tarsi and short toes, with a ratio of 52%. This species has a very catholic diet consisting of grasshoppers, large frogs, lizards, snakes, beetles, rabbits and birds; they also feed on carrion. On Tasmania, about 80% of the diet in summer is made up of insects and reptiles, but in winter the main constituents are mammals and carrion, which contribute about 30% each.

Breeding

In details of breeding biology, the family Falconidae contains some of the best known, as well as some of the least known, of birds. Many falcons and their breeding habits have been studied for centuries, but, by contrast, the first forest-falcon nest was not discovered till the 1970's. Falconids are ostensibly monogamous and most nest as solitary pairs. They tend to be conservative breeders with rather stable breeding populations. A feature of their breeding is the division of duties between the sexes; the females brood, feed and defend the nestlings while the males do most of the hunting for the family.

The typical image of a falconid is as a solitary nester, yet more than 10% of the species nest in colonies, at least occa-

sionally, and many of these characteristically nest gregariously. These aggregations range from the dense colonies of Eleonora's Falcon to the loose, occasional colonies of the Striated Caracara. The former always nests colonially, with pairs as little as two metres apart, on rocky islands, preferring an array of sites whereby neighbouring pairs can not view each other from the nest. Where nest-sites are limited, caracara pairs sometimes nest less than ten metres apart, among grass tussocks or on rocky ledges. A colony of Lesser Kestrels, with birds nesting in the holes and ledges of a rockface, may number 100 pairs. Within all these colonies the birds breed as individual pairs. In contrast, communal nest guarding and brood care are reported for the group-living Red-throated Caracara, forms of behaviour that have not yet been observed in any other falconid. Such co-operative breeding may be related to the caracara's specialized foraging habits, as a lone pair may have difficulty sustaining a breeding attempt, although this can apparently happen on occasions; the subject warrants further study.

Odd instances of polygyny, a form of polygamy, have been recorded for the Common Kestrel, the Peregrine Falcon and the Merlin, usually involving a male attending females at two neighbouring sites. In other unusual threesomes, the extra bird was also a female, but did not breed: for example, 26 pairs of Peregrine Falcons in France were attended by an additional, generally first-year, female and achieved greater breeding success than lone pairs.

Most falcons are territorial breeders and, where food, habitat and nest-sites allow, spacing between breeding pairs is often fairly regular. Some species are resident in and around their nesting territory all year, whereas others migrate or wander, and return to re-establish territories just before the next breeding season. Larger species and bird-eaters tend to space themselves more widely than smaller species and eaters of mammals, reptiles or insects, but other factors are also involved. Communal nesters are usually dependent on prey that is abundant but transient, such as insect swarms or migrating passerine flocks, and around such prey sources nest-sites tend to be concentrated.

Even in the tropics, most falconids are seasonal breeders and breed annually. They often lay between late winter and



The Peregrine Falcon is one of the supreme predators. It takes mainly avian prey, which is habitually killed in mid-air, following a breathtaking stoop, in which the falcon may reach speeds of around 180 km/h. Note the elongated middle toe, typical of a bird-killer, which helps this immature bird to grip its prey, a Ring-necked Pheasant (*Phasianus colchicus*). As in the Accipitridae, falcons often perform a Mantling-display over their prey.

[*Falco peregrinus*.
Photo: A. & S. Carey/
Vireo]

early summer, but the timing ultimately depends on the seasonality of availability of the particular species' prey. Typically, the breeding season coincides with an influx of prey species, or an increase in their availability, or both, which continues or intensifies until after fledgling independence. Photoperiod and latitude have been shown to be related to the timing of breeding of some falcon species. Experienced birds tend to lay earlier in the season than inexperienced pairs. A few individuals of some kestrel species may breed twice in a good year, in spring and autumn. The falconets, at least the African Pygmy-falcon, sometimes produce a second brood, the same size as the first, as soon as two weeks after fledging the first.

Characteristically, members of the family do not build a nest, but simply rearrange the substrate of the nest-site to form a smooth depression to hold the eggs. This is achieved mainly by scraping with the feet and shuffling the body, with some moving of larger items with the bill. Some species, for example Australian Kestrels and Brown Falcons, may add a small amount of bark or leaves to line the nest cup. Although a few falcons are claimed to construct a nest, caracaras are the only substantiated exception; they often construct a nest of sticks from scratch, and line it with wool, dung and other matter. Many falconids are dependent on other species, including other raptors and corvids, to construct nests. In Southern Africa, the Lanner Falcon commonly breeds in raven nests on power pylons. In certain areas and for some species, breeding is constrained until a nest becomes available or can be appropriated.

The choice of nest-site can be flexible or fixed, both within and between species. Typically, the cosmopolitan Peregrine Falcon nests on cliffs. Where cliffs are scarce in areas of abundant prey and habitat, they may use other locally available sites: in Australia they commonly nest on cliffs, but also in large stick nests and large cavities in trees; in Finland they nest on the ground in bogs. The New Zealand Falcon nests on cliffs, in epiphytes, or on the ground under a log, rock or other object. Old rookeries are favoured by colonially-nesting Red-footed Falcon, whereas the *Microhierax* falconets usually breed in old barbet or woodpecker holes. Huge, active communal nests of sociable weavers, in open country, often provide nesting and roosting sites for a pair of African Pygmy-falcons. Likewise, the closely related Spot-winged Falconet uses the communal

nest of Monk Parakeets, but, unlike the African Pygmy-falcon, it sometimes supplants the parakeets. The crotch or cavity of a tree or a ledge on a power pylon have all provided a nest for the Laughing Falcon. Falconids nesting in stick nests may use an empty nest or evict the builder; for example, Grey Kestrels will evict Hamerkops (*Scopus umbretta*) from their domed nests. Increasingly, buildings and other imposing structures provide suitable sites for some cliff-nesting falcons. Preferred sites are usually sheltered from extreme conditions, such as prevailing winds and the heat of the day. Typically, falconids use a traditional nest-site, or an area with a few alternative sites, for generations.

The pair-bond lasts all year in resident species, but in those that spend the non-breeding season elsewhere the male tends to return to the nesting area first. The male appears to have greater attachment to the nest territory than the female and may perform spectacular, aerial territorial and courtship displays of his speed and agility, accompanied by excited chittering in at least some *Falco*. The pair may soar together, and one bird makes mock dives at the other, which rolls and presents talons. Pair-bonding in some forest-dwelling species, such as the forest-falcons, may involve spirited vocal performances. At dawn and dusk, the members of a nesting pair of Laughing Falcons join each other near the nest, to perch in an erect posture and perform a duet. Individual established pairs seem to display less vigorously than newly formed pairs. Females tend to prefer to pair with older males on the better quality territories and are more likely to change partners than are males, particularly after a breeding failure. Nevertheless, the majority stay with the same partner. During the pre-laying period, which may only cover three weeks in some migrants, conflict with an aspiring usurper or challenger sometimes occurs, usually involving an aerial chase and occasionally resulting in a fatality.

In many species the male escorts the female to potential nest-sites and sometimes displays at the site. Bowing, submissive crouching by the female, and whining and other calls, are components of a display at a perch, which may lead to copulation. However, copulation can occur without formality.

A remarkable aspect of copulation in falconids, and in raptors in general, is its frequency. For example, the Prairie Falcon

Many falcons are capable of catching prey considerably larger than themselves, although they normally seem to prefer prey species of more manageable sizes. The Red-necked Falcon habitually takes birds up to the size of doves. It is a dashing hunter that catches its prey after a rapid pursuit flight.

[*Falco chíchquera*.
Photo: Clem Haagner/
Ardea]



copulates an estimated 194 times per clutch, spread over the pre-incubation period of 51 days, beginning weeks before the female's fertile period. Among the proposed explanations for such an apparent excess, the ideas of sperm competition and pair-bonding, which are not mutually exclusive, appear to have the most support. A male bird of prey provisions the female and is absent from his partner for relatively long periods, compared with birds that guard their partners, so the chance for extra-pair copulation and cuckoldry is high; frequent copulation enhances the chance of paternity. However, only three of 41 copulations were extra-pair in Merlins and none for a Prairie Falcon pair. This is not a high rate of cuckoldry, but, nevertheless, the cost of provisioning unrelated offspring is high and seemingly worth avoiding.

It might be expected that courtship feeding and copulation are connected. Although within pairs food does not appear to be traded for copulation, poorly fed females are likely to seek food from other males and copulate with them. Conscientious courtship feeding may therefore enhance mate fidelity.

Typically, the male hunts and brings food to the nest-site and the female flies out to meet him at a perch. He transfers the prey from his bill to his feet and offers it to her. When not hunting, and particularly during the female's fertile period, the male stays close to the nest. Courtship feeding appears to help the female lay down fat reserves for egg formation, and the few studies performed indicate that females in better condition are most likely to breed successfully. It may also allow her to judge whether the male will be a good provider, capable of supporting a breeding attempt.

The handsome buff eggs, well speckled with the dark red-brown of haemoglobin, are a feature of the family. The eggs are ovate, with one end slightly more pointed than the other, and the chemical composition and structure of the shell is also unique. As with all birds, within the family egg size is generally related to body size, and the more dimorphic species tend to have relatively small eggs. Compared with other bird groups, members of this family lay rather large eggs; for example, a 100 g kestrel lays a 15 g egg, whereas a dove of similar weight lays a 6 g egg. This is due in part to differences in the mode of development: the falcon chick hatches in a more advanced state than the dove.

Falconid species lay every second or, occasionally, third day, and if eggs are removed daily a female will continue to lay. Many falcons lay 3-4 eggs per clutch, but kestrels lay more and hobbies less. The hobbies lay a clutch of 2-3, whereas other small falcons and falconets lay up to 6 or so, and larger falcons up to 5 eggs. Species occupying harsher climes tend to lay larger clutches. Caracaras lay 2-3 eggs, and for the unusual Laughing Falcon 1 egg appears to be the norm, perhaps a characteristic of snake-eating raptors, including the accipitrid genera *Circus* and *Spilornis*. If a clutch is lost early in the season, many pairs will relay, starting a minimum of two weeks later.

In general, variability in the availability of food does not greatly affect clutch size, but prey scarcity may lead to non-breeding or a clutch being abandoned. Inclement weather, predators, parasites, human interference and other factors cause egg failure or nestling loss, which often averages approximately one egg per successfully breeding pair. Nesting density may also affect reproductive success. Falconids and other raptors are particularly sensitive to the pesticide DDT, which can cause them to lay thin-shelled eggs and result in egg breakage (see Status and Conservation). On average, clutches laid early in the breeding season are more successful than those laid later, and it often turns out that they are laid by the more experienced pairs. Unlike some of the accipitrids, falconids do not practice siblicide, but chicks that die may be eaten by their parents or nest-mates.

The commencement of incubation is variable even within species, but it does not usually begin at least until the second or third egg has been laid, so that hatching is often, but not always, fairly synchronous. Characteristically, falconids have a single brood patch. The bulk of incubation is carried out by the female, although during the day the male may relieve her for short periods, usually while she feeds or preens; occasionally in some species and some individual pairs the male may take over for longer. For annual breeders, moult usually commences during the egg-laying period for the female, and few weeks later for male. Roughly related to body size, the incubation period averages about 28 days for falconets and smaller falcons, up to 35 days for the large Gyrfalcon. After the chicks have hatched, the eggshells are often eaten; alternatively, they may be removed from the nest.



The Gyr Falcon, the largest and heaviest of the falcons, normally relies significantly on grouse and ptarmigans of the genus *Lagopus*, although ground squirrels and lemmings can be very important locally, as can some colonially breeding seabirds. Prey tends to be caught on the ground and it is often plucked and decapitated on the spot. A lone, unpaired male in Yukon, Canada, was recorded carrying prey back to its territory, where it performed a lengthy "Wail-and-pluck" display, apparently in an attempt to attract a female.

[*Falco rusticolus*,
Yukon, Canada.
Photo: Erwin & Peggy
Bauer/Bruce Coleman]

Most chicks take 24-72 hours to hatch. They are semi-altricial, rather helpless, and hatch in a sparse coat of white down, with their eyes sealed closed. They are brooded almost continuously, by the female, for about the first 7-10 days. Within a few days the eyes open, only about two days in kestrels and four in Peregrine Falcons, and by the second week a thick, woolly second down (preplumulae) has replaced the first. Growth is rapid and the wing quills begin to appear on about day 6 in the falconets, and day 9 in the larger falcons. The tarsus and bill are fully grown after about three weeks in kestrels and three and a half in Peregrine Falcons. Young are offered pieces of food by the adult, almost always the female, from their first or second day until later in the nestling period when the prey, sometimes partly plucked, may simply be left on the nest. The nestlings can tear prey by half way through nestling period, but they still prefer to be fed by an adult. About a week before fledging, falcon nestlings often reach higher weights than their parents, but this excess weight is lost over the following week. Fledging occurs after about 28-30 days in the nest for small falcons and falconets, up to 49 days for the largest falcons, and perhaps 8 weeks for caracaras. Males fledge a day or two younger than females.

After fledging, the young stay close to the nest, often returning to roost there at night. They gradually hone their flying and hunting skills, which they can learn to master even in the absence of parental guidance. Nevertheless, the parents, particularly the male, must continue to support them by providing some food, and they are often hounded by hungry fledglings. The fledglings of some migratory species, for example Eleonora's Falcon, are said to leave on migration as soon as 15 days after fledging, whereas others, such as the Lesser Kestrel, depart with their parents after 6-8 weeks. The fledglings of most species remain in their natal territory longer, often accompany the parents to hunting areas, and eventually leave after a period ranging from several weeks to several months. Larger species and those with greater size dimorphism tend to take longer to reach full independence, but the fledgling period is highly variable both within and between species, and can in any case be difficult to monitor.

Recent studies have shown that the sex ratio of nestling falcons is often biased, with broods raised early in the season

differing from those raised later. Interestingly, although female nestlings are larger and theoretically more costly to raise, the bias is not always towards males.

The evident difference in size between the sexes, with the female in some species reaching over 150% of the male's weight, has spawned a plethora of theories. Although none has gained widespread acceptance, in general intrasexual selection is thought to be a more influential source of body size differences than intersexual selection. The simplest argument is that in most species with RSD (reversed size dimorphism), the roles of the parents are different. Males provide virtually all the food to the female and young nestlings; because small adults are more agile fliers, small males are favoured. Females compete among themselves for high quality males with territories and nest-sites, and are therefore under intrasexual selection for competitive ability, and hence large size. Selection on the sexes therefore works in opposite directions. The degree of dimorphism is greatest in hunters of agile, difficult or dangerous prey, because there are relatively few competent breeding males in these species, so that competition between females is strong and selection for large size greater than in hunters of less difficult prey.

Small falcons are capable of breeding at one year old, before they attain adult plumage. Typically, larger falcons first breed at two to three years old, with males usually averaging a year older than females. Larger species can breed into their twenties, but smaller species probably for around 15 years. There have been few studies of sufficient scope, but these indicate that reproductive success may increase over the first few attempts, although it does not decline with old age. Lifetime reproductive success of falconids is virtually unknown and remains an exciting challenge for researchers.

Movements

Most species of falconid living in low latitudes and tropical areas, such as the caracaras, forest-falcons and falconets, are sedentary or dispersive. Those that do migrate, mainly members of the genus *Falco*, are principally diurnal migrants, but they tend to be well on their way at first light and may not roost for

The African Pygmy-falcon is remarkable in that it roosts and breeds in the nests of weavers. In southern Africa, it invariably occupies the huge communal nests of Sociable Weavers (*Philetairus socius*), and in the Kalahari region roughly a quarter of all such communal nests have pygmy-falcons resident. Occasionally, the species preys on its host weavers or their young.

[*Polihierax semitorquatus*,
Kalahari Gemsbok
National Park,
South Africa.
Photo: Günter Ziesler]



the night until after dusk. One Peregrine Falcon, with a radio transmitter attached, flew over open ocean right through the entire night. Some movements are over very long distances, with birds moving south from about 70° N to 35°–40° S. Most of the migration is accomplished by powered flight, so birds may put on weight by depositing extra fat prior to the migration; in the case of the American Kestrel, with a 4% weight increase over midsummer, females gain more than males. Some species, such as Australian Hobbies, follow flocks of migratory passerines that are important prey, and these species may, as with Eleonora's Falcon, catch and feed on prey on the wing; this habit might be especially important for flights over water.

Falcons in which all individuals of the species migrate are the Lesser Kestrel, the Red-footed and Amur Falcons and the Eurasian Hobby, all of which move from Eurasia to Africa, although the hobby is actually a local resident and breeder in areas of North Africa. Two other classic cases are Eleonora's and the Sooty Falcons, which move from the Mediterranean area mainly to Madagascar. The Merlin was at one time considered a completely migratory species, but some remain on their northern breeding grounds in the British Isles, Iceland, some central Asian mountains, for instance the Tien Shan, along Canada's Pacific Coast, and locally in parts of the Canadian south central prairies. Lesser Kestrels and Red-footed and Amur Falcons breed in social groups and often travel in mixed species flocks. Eleonora's Falcon, which breeds typically in rather dense social colonies, apparently migrates singly or perhaps in small groups.

Other species are partial migrants. For example, in one of the truly spectacular Northern Hemisphere migrants, the Peregrine Falcon, populations at middle to low latitudes are resident, with any movement dependent largely on weather and food supplies. Food loss shortly after breeding also determines, for example, when some Prairie Falcons move. Ground squirrels, which constitute the main food supply of this species, go into aestivation during the heat of mid-summer, shortly after the young falcons fledge, and thus the entire population of falcons disperses by mid-summer to find another source of food. In the Southern Hemisphere, movement may take place from south to north in the non-breeding winter season. The Australian Kestrel and Australian Hobby are partly migratory,

as each year some of the population moves north towards New Guinea, the islands of the Torres Straits and as far as Java and Bali.

Regardless of the extent of movement, falconids show a great deal of philopatry, a tendency to return to an area near their place of origin, when ready to breed. This tendency is responsible, in part, for the great geographical variation in such species as the American and Common Kestrels, and the Peregrine Falcon; geographical variation becomes fixed because of constancy in the gene pool.

The Crested Caracara demonstrates one of the problems in trying to understand movements among sedentary species. Throughout its breeding range it can be found in both summer and winter, even at the northern and southern ends of its range, in the southern USA and Tierra del Fuego respectively. This does not mean that given individuals stay put all year round, nor that they do not disperse nor wander. But identification of dispersive movements requires either good ringing data clearly showing any movements, or sightings of birds outside the normal range of that species or subspecies. In North America, some caracaras wander northward outside their resident range into New Mexico and Oklahoma at various times of the year.

Many such dispersive birds are presumed to be younger or non-breeding birds. For example, Australian Kestrels that reach New Guinea are mainly juvenile females. Likewise, in the Gyrfalcon, adults tend to remain on the breeding grounds while juveniles wander. Those Gyrfalcons that show up in the central USA south of about 50° N, some 2000 km south of the breeding grounds, are normally young of the year. However, in years of extreme food scarcity the entire population of the species may move south, so that adults show up in greater numbers. Some wandering juvenile Gyrfalcons with attached radio transmitters, tracked by C. McIntyre and R. Ambrose, were monitored from the ARGOS polar orbiting satellite system. Between 17th September and 18th October, one bird moved from the Seward Peninsula in Alaska some 3400 km to the Sea of Okhotsk, where it remained until signals ceased in March. Another moved from the Seward Peninsula on 12th August, to Anadyr in eastern Siberia by 17th September, and back to mainland Alaska near Norton Sound by 5th October, then south 800 kilometres to Kodiak Island in Alaska by 11th October, where



Falcons do not build a nest, but rather occupy some suitable existing site, which can be, for instance, a tree hollow, a cliff ledge or the nest of another species. The availability of suitable sites can be a limiting factor in some cases. The New Zealand Falcon has been found to have greater breeding success at cliff sites than on flatter ground.

[*Falco novaeseelandiae*.
Photo: M. F. Soper/NHPA]

it remained until February, when signals ceased. All sibling Gyrfalcon groups with radio transmitters attached had disassembled by 15th September, so that fledglings dispersed alone from their natal areas.

The Black Falcon of Australia is another example of a dispersive species with movements that are generally influenced by weather and food. During drought in the interior they may move to coastal areas, and there may be irruptive movements away from the interior, perhaps sparked off by food shortages. Certainly their seasonal movements are partly linked to movements and fluctuation in abundance of their favoured prey, notably quails and grasshoppers. They breed well during rat plagues and then disperse coastward as the rats die out, especially if a drought follows.

In the Northern Hemisphere some species perform "leap frog" migration, with those from farthest north wintering farthest south. For example, members of the Peregrine Falcon's Eurasian subspecies *calidus*, that breeds in the tundra zone, fly in a broad front over some resident populations of nominate *peregrinus* of the southern Eurasian taiga, over *brookei* of the Mediterranean area, and *pelegrinoides* of southern Asia and North Africa, to winter in the breeding ranges of the race *minor* of Africa, *peregrinator* of the Indian Subcontinent, and *ernesti* of south-east Asia and the Papuan subregion. Some taiga breeders of the race *peregrinus* also move south, flying over some of the same races, but wintering north of most members of *calidus*, so that they have a shorter migration, leaving from further south and stopping further north than *calidus*.

There are often sexual differences as seen in the American Kestrel, with females departing first, about eleven days earlier than males, and moving further south. Australian Hobbies and Kestrels that move away from Australia tend to be females, and after winter dispersals male kestrels tend to return to breeding areas earlier than females.

Migrations may take place over a broad front with some falcons, for example, making significant crossings over water. Common and Lesser Kestrels and Red-footed Falcons move in a broad front over the Mediterranean Sea, on their way from

Europe to Africa. Other falcons, such as Peregrine Falcons, move in a broad front over land but then many end up at concentration points along seashores. Some Peregrines end up in the middle of the Pacific Ocean, even south of the equator, several thousand kilometres from their starting points in the Northern Hemisphere. These birds may have been blown off course during migration, or they may have wandered that far as a natural part of dispersal.

Some well observed concentration points, or "bottlenecks", in the Old World, through which the falcons appear to funnel, are Israel, Cap Bon (Tunisia), Malta and Crete. In North America and the Neotropics, typical routes follow the Atlantic seaboard, in Maryland, New Jersey and Florida, while others include the Texas Gulf Coast, Veracruz (Mexico) and the Pacific seaboard of Ecuador and Peru. These migratory concentration points provide important data for judging the population status and trends in some species. For example, at Assateague Island in Maryland (USA) only 41 Peregrines were counted in 1972, when their populations were at low numbers following biocide reductions, but a peak of 813 were counted in 1989, when Peregrines were well on their way to recovery.

Two interesting examples of migration are provided by the Amur and Eleonora's Falcons. The former leaves its breeding grounds in eastern Siberia and northern China in the autumn, taking a route south of the Himalayan massif, across India. Then the birds must cross the Indian Ocean, before hitting land in East Africa, generally south of Somalia, and moving on to winter on mainland Africa mainly between Malawi and the Transvaal of northern South Africa. In spring, they take a different route, passing northward through Somalia, Arabia and Afghanistan, and thence to their breeding grounds. Over parts of both migrations the falcons travel in the company of large flocks of Lesser Kestrels. Eleonora's Falcon breeds in the Mediterranean and North African region from the Canary Islands east to Cyprus. In autumn, movement is eastward through the Mediterranean, then southward, down through Suez and the Red Sea, thence around the Horn of Africa, to end up mainly in Madagascar. Birds from the Canary Islands and coastal West

Merlins nest on trees, cliffs or the ground, depending on local availability. Three to six eggs are laid, and these are incubated for 28-32 days by both sexes, although the male tends to relieve the female only for rather short spells, as is the norm within the family.

[*Falco columbarius*.
Photo: Dennis Green/
Aquila]



Africa must move north-eastwards first, into the Mediterranean, before proceeding east. Few are known to occur inland in North Africa, nor are many seen far inland in East Africa. Some do end up, however, not in Madagascar but on the mainland of southern Africa, as much as 400 km inland. Because the species breeds between late July and early September, young birds must set off on the long journey to their winter quarters only about 15 days after fledging!

Relationship with Man

Although falcons and their kin do not have as long a recorded association with man as do some very large raptors, such as eagles and condors, nor do they generally have the same element of folklore surrounding them, nevertheless there have been many close links between falconids and man over the years.

Forest-falcons are secretive, and generally poorly known, so would rarely attract the attention of man. Falconets are small and similarly do not elicit the sort of attention that could give them a very intimate relationship with man. Caracaras, however, were important in early civilizations of Central America. In AD 1325 the Aztecs began to build the city of Tenochtitlan on a rise of land within the lake where present day Mexico City stands. The ancient omen to be looked for, according to Aztec legend, was an "eagle" perched on a cactus eating a snake. Apparently, when what was presumably a Crested Caracara was seen sitting on a cactus, that was fulfillment of the omen, and the caracara thus became the necessary "eagle". Today, the caracara is the national emblem of Mexico. The caracaras also have a place in the folklore of Ecuador and Peru: one mated with domestic fowl is said to produce a highly desirable fighting cock. Perhaps this is a logical connection for native peoples to make, as caracaras do strut around on the ground rather like chickens, and they are also aggressive.

Most of man's relationship with falconids, however, revolves around the genus *Falco*. At least in the period

2400-2500 BC falcons played a major role in Egyptian religion and mythology. Horus, the Egyptian sky God, or God of the heavens, took the form of a falcon. In fact, there arose several distinct falcon Gods, one in particular was at Nekhen, a place known to the Greeks as Hierakonpolis, meaning "falcon town". Horus was sometimes depicted in Egyptian paintings as a king or ruler, as well as in the form of a God. The eye of Horus had health giving properties and was a popular amulet. It is really not clear what falcon Horus was depicting. Since the Lanner Falcon is a large, conspicuous falcon of that region, often nesting on pyramids and other man-made structures, this may be the falcon on which the Horus representation was based. The desert race *pelegrinoides* of the Peregrine, known as the Barbary Falcon, may be a good candidate too. As sacrificial gifts, preserved "falcons" wrapped in fibre, as though in a burial state themselves, were offered to Horus. At one tomb near Saqqarah, Egypt, dating to 1000-2000 BC, these sacrificial "falcons" number in the thousands. Most are too small to be a Lanner or a Barbary Falcon, and while the number seem too great for them all to be falcons, those few that have been unwrapped have, in fact, proved to be *Falco*, although the species remain unidentified. Because of the small size of the "mummy falcons" they may be small flocking species, such as Lesser Kestrels, that move through the region during migration. It would be an intriguing study to determine the true nature of the species that comprise these "falcons". Old Testament Biblical writings may also refer to a falcon, though not by name in most contemporary translations. The keen-eyed bird of Job, is taken from the Hebrew *ayyah*, meaning "echoing" or "a screamer". The more precise translation for that bird would be "falcon" rather than the "vulture" of most translations.

The Brown Falcon figured importantly in the life of some Australian Aborigines, not only for food but in their legends, such as those dealing with fire. This may have been because the Brown Falcon frequents fires to catch birds and insects flushed by the flames and smoke. Aborigines even went to the extent of lighting bush fires, to their advantage in hunting too,



The semi-altricial chicks hatch with a sparse coat of whitish down, but by the second week a second, thicker coat has already replaced the first. The female Greater Kestrel stays with her brood constantly at first, probably in order to protect them from potential predators, such as crows. The male has to supply all the food at this stage; he delivers it to the female, and she feeds the chicks. Note the adult's pale cream iris, which gives rise to the species' alternative name, White-eyed Kestrel.

[*Falco rupicoloides*
rupicoloides, South Africa.
Photo: J. J. Brooks/Aquila]

so they would have been very familiar with the falcon. In fact, the aboriginals had 29 names for the Brown Falcon, as compared with 20 for the familiar Australian Kestrel and 10 for the Peregrine.

In 1741, during Vitus Bering's historic Second Kamchatka Expedition, when Europeans first encountered Alaska and Aleut natives, Georg Wilhelm Steller recorded the use of falcons in Aleut practices. Steller wrote that, tied to a long stick were two falcons' wings, which the Aleuts laughingly threw into the water towards their boat; he could not tell whether it was meant as a sacrifice or a sign of good friendship. Regardless of the meaning, the stick with falcon wings attached was certainly an important part of Aleut culture. Peregrines are abundant in the Aleutian Islands, often nesting in very accessible locations, so they would have been of easy access to Aleuts.

There has been no closer relationship between man and the falconids than through falconry, and R. T. Peterson wrote that "man has emerged from the shadow of antiquity with a Peregrine on his wrist". The sport of falconry probably had its origin in the dusts of ancient Persia, Arabia, India and China, most certainly as early as 2000 BC, but the earliest recorded images are from the Middle East, dating to about 720 BC. Falconry was known to be extensively practised in China by 650 BC and throughout much of the Far East around AD 300-700. Perhaps the peak of historical falconry, often called the sport of kings, occurred in the period AD 500-1600 among Europeans and Asians. Certainly the great Genghis Khan in the twelfth century was an avid hunter with falcons, as were the royal courts of Britain in the sixteenth and early seventeenth centuries. Falconry must have been a part of everyday life during that period in Britain; even nuns took their falcons to chapels. Shakespeare referred to falcons or falconry in 17 of his plays, for example: "as confident as is the falcon's flight against a bird," or "as...the falcon her bells, so man hath his desires." There was great demand for large falcons, especially white Gyrfalcons, and this resulted in a rather significant trade of birds from Greenland and Iceland (see Status and Conservation).

The sport has probably never been more popular than it is today with perhaps 10,000-20,000 practitioners. Falconry is most identified with the large falcons, such as the Gyrfalcon and the Peregrine, Saker and Lanner Falcons; it has perhaps never been a part of any culture more than in the Arab and Persian worlds. In any given year as many as 3000 falcons are

being trained in the Middle East, 90% of them female Saker Falcons.

As a result of the controversy, problems and negative impacts associated with collecting the birds from the wild, many species are now being bred in captivity for the sole purpose of falconry. Apart from zoos and the breeding of falcons for falconry, many falconids have been bred in captivity for research projects, or simply for amateur interest. Pygmy-falcons, *Microhierax* falconets, and at least 21 species of falcons have been bred thus. Many of these species have been hybridized, mainly by means of artificial insemination, and the implications arising from the results help to support some systematic conclusions. Many of the hybrids have proved to be infertile, depending on the gender, such as a Prairie Falcon crossed with a Peregrine Falcon, or the offspring of a Peregrine and Gyrfalcon being back-crossed with one of the parental types. Outcrossing, such as trihybrid crosses, also produce young. Much of the captive breeding effort started because of the deleterious effects of synthetic chemical biocides, and subsequent efforts to bolster or reintroduce populations that had been reduced or eliminated (see Status and Conservation). Because of the ease of captive breeding, no species of falcon need ever become extinct.

Some falconids have adjusted well to urbanization. For instance, caracaras frequent rubbish dumps, and falcons, such as Peregrines and kestrels, breed on city buildings, smoke stacks, billboard road signs along heavily used roads, and on major bridges joining urban areas.

The names of falconids, in particular the falcons, appear in many ways in everyday life, without our perhaps being truly aware of it. A large housing development near a lake, used as a Peregrine Falcon release site during reintroduction efforts in Utah (USA), was named Peregrine View Estates. Professional as well as secondary school sports teams carry their names: the American football team Atlanta Falcons in Georgia (USA), for example. Some place names are also taken from falconids. In the Brazilian state of Bahia, there is the town of Caracara; Caracara is, in fact, an indigenous name thought to resemble the call of the bird. Other examples are the state of Falcón in Venezuela, Falcon Reservoir on the border between Texas (USA) and Mexico, Falkenberg in Germany, Cap Falcon in Algeria, Capo del Falcone in Sardinia, Falconara Marittima in Italy and Falcon Lake and Peregrine Creek in Alaska. One mountain peak in northern Alaska is named Okiotak Peak, the name coming from Nunamiut Eskimo for "one that stays all



The Common Kestrel, extremely well adapted to environments heavily altered by man, nowadays frequently nests in or on buildings, particularly bridges or church towers. As in other falcons, the male has to do most of the hunting during the first part of the nestling period, while the female stays with the chicks and broods them. Since hatching tends to be fairly synchronous in falconids, the size difference between siblings is less marked than in some of the Accipitridae, although it can still be substantial, as is clearly visible in this brood, especially as female chicks tend to be larger than male ones. Nevertheless, the sibling aggression that typifies some eagles is not found in the Falconidae, so if food is sufficiently plentiful the youngest chicks too can be successfully raised.

[*Falco tinnunculus*.
Photo: Eric & David
Hosking/FLPA]



The Grey Kestrel usually breeds in a Hamerkop (*Scopus umbretta*) nest, either occupying a disused nest, or even, on occasion, ejecting the Hamerkops. Because of the security offered by the huge, elaborate nest, the female can leave the chicks alone unusually early and go off to help the male with the business of searching for food; she normally stays with the chicks only for the first five days.

[*Falco ardosiaceus*.
Photo: Alan Root/Survival]

winter", and referring to the Gyrfalcon; historically, falcons used a conspicuously prominent cliff on that mountain slope.

Status and Conservation

Taking the family as a whole, the Falconidae have fared quite well relative to other raptors, and only one falconid has definitely become extinct in historical times. Nevertheless, all species are included on Appendix II of CITES, except those that are on Appendix I. The species classified as most threatened are all falcons or forest-falcons.

As with most animals during the present century, the sheer density of the human population has reduced the amount of habitat available, and unless species can adjust to human alterations they are eliminated. For example, the building of homes in canyon mouths below cliffs and the turning of native shrub-steppe habitat to agricultural use have locally reduced populations of Prairie Falcons. This falcon has not adjusted to human encroachment in the same manner as the Peregrine Falcon, and it has disappeared from areas adjacent to most conurbations. The continuing commercial logging of tropical forests or their conversion to agriculture must have serious impacts on the forest-falcons, and perhaps also on falconets, that otherwise are seemingly quite secure. Alterations of habitats have both negative and positive effects on falconids. Australian Kestrels and perhaps Black Falcons appear to have expanded their ranges with the clearing of forests, and the man-made permanent water bodies scattered across Australia have probably benefited many *Falco* species, particularly in arid regions. Chimango and Crested Caracaras have benefited from the increasing amounts of carrion and human refuse available. Some caracaras, in particular the Chimango and Yellow-headed Caracaras, seem not to have been adversely affected by habitat alterations, but have probably suffered from direct human persecution.

Two caracaras in particular have suffered considerably at the hands of man, one of them to the extent that it became extinct, the only falconid definitely known to have been lost in modern times, at any rate since 1600. The Guadalupe Caracara was restricted to Guadalupe Island, a small 32 x 10 km

island, 225 km west of the coast of Baja California, in north-west Mexico. This species was completely eliminated by direct and deliberate human persecution. E. Palmer secured the first specimen, which eventually ended up in the hands of R. Ridgway, who described it as a species new to science in 1876. Little did Palmer realize that within 25 years the species would be extinct. The caracara was called "Calalie" by locals on the island, and Palmer wrote that it "...is abundant on every part of the island; and no bird could be a more persistent or more cruel enemy of the poultry and domestic animals. It is continually on the watch, and in spite of every precaution often snatches its prey from the very doors of the houses." Local inhabitants shot caracaras to protect young Angora goats. Caracaras were described as attacking kid goats, sometimes grabbing the kid's tongue and pulling until it was ripped out, leaving the kid to starve to death. By 1885, mention was made of how easily caracaras could be killed with a rifle, when they came to drink from shallow pools; if missed, they would take not the slightest notice of the shot, and would wait quite unaware of their peril. In fact, populations had been so reduced by 1885 that on a two day excursion on the island W. E. Bryant saw only four birds. The final blow seemingly came, unfortunately, from scientists rather than from locals. The scientific collector R. Beck was on Guadalupe on 1st December 1900, when, from a flock of eleven birds flying over, he shot nine, and remarked in a letter "...judging from their tameness and the short time that I was on the island, I assumed...that they must be abundant." None was seen after that. Ironically, the people raising goats left the island shortly after the last caracara had died.

Fortunately, the Striated Caracara has fared rather better. Also an island form, it has a much wider distribution, but is nonetheless restricted to the Falkland Islands east of the southern tip of Argentina, and several islands south of the Beagle Channel on mainland South America. Charles Darwin remarked, during his visit to the Falkland Islands in 1833 and 1834, that the caracara was "exceedingly numerous at the Falklands" and was "extraordinarily tame and fearless, and constantly haunted the neighbourhood of houses to pick up all kinds of offal." Its tameness and habit of preying on weak lambs or sheep was its downfall. Persecuted ruthlessly by

The breeding habits of most of the caracaras is still rather poorly known. One significant difference between these species and the other members of the family is that the caracaras build nests. The Striated Caracara builds a fairly simple nest of dry grass and lines it with wool, if available. In the Falkland Islands, young birds are apparently independent of their parents by March, some three months after hatching.

[*Phalacrocorax australis*,
Falkland Islands.
Photo: Hermann Brehm/
Bruce Coleman]



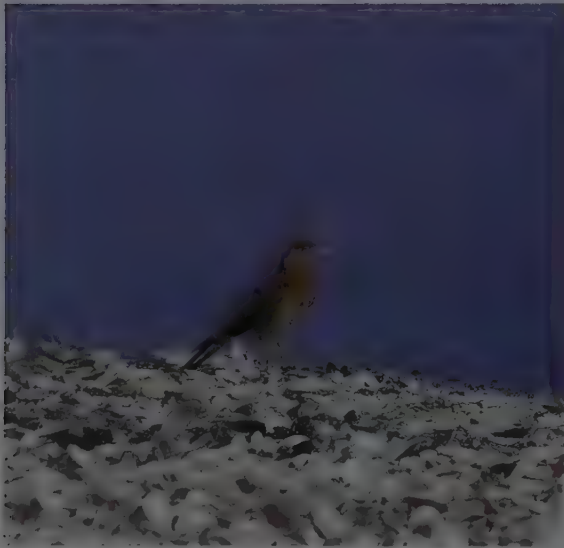
farmers, by 1910 it had decreased over much of the Falklands, and even today it is generally confined to the extreme west side of West Falkland, outlying islands farther west, and a few islands by the South American mainland, to the south of the Beagle Channel. There are no estimates of population size, probably because of the remoteness of the habitat, but 200 were estimated to be on Barnavelt Island in the 1920's; the species is locally numerous, and seems to be secure for the present.

Two of the six species of forest-falcons have relatively extensive distributions, covering enormous expanses of Neotropical forest, and two others seem fairly common in appropriate habitat. Buckley's Forest-falcon (*Micrastur buckleyi*) is known from very few museum specimens and sight records from Amazonian Ecuador and adjacent north-east Peru. In 1992 it was also reported from Brazil, but the record has now been withdrawn. Seemingly rare, it is so poorly known that most comments about its status are necessarily speculative. The Plumbeous Forest-falcon may be equally rare. It is confined to a very small region on the Pacific slope of south-west Colombia and adjacent north-west Ecuador, in the province of Esmeraldas, and to date all sightings have been made at altitudes below 1000 m; likewise, there are no population estimates. Reliable data on both of these species are particularly hard to come by because Buckley's Forest-falcon is a smaller version of the Collared Forest-falcon and may be confused with it, while the Plumbeous Forest-falcon is sympatric and easily confused with the superficially similar and common Lined Forest-falcon. Deforestation, taking place in the range of both of these apparently threatened species, and the growing human population in Esmeraldas are the current threats to their security, especially if they really are rare. The Slaty-backed Forest-falcon, in spite of its apparent rareness, is not listed in the 1992 Red Data Book of the Americas, perhaps because it has such an extensive range. Surveys may yet show that these three forest-falcons are actually more common than is currently believed, as has proved to be the case with the Lined, Barred and Collared Forest-falcons. The three latter species have been found to have high populations in some areas with home ranges of about 67, 114, and 712 hectares respectively, and in some cases the home ranges of

conspecifics abutted. This genus was so poorly known that nests were not found until 1978, but once it was discovered where exactly to look for them some 50 nests have been located, mostly in Guatemala.

Deforestation is also the main threat to the falconets, although again they are not very well known in general. As most of the species tend to favour forest edge and clearings, rather than the deep interior of the forest, they may be able to withstand a certain amount of habitat alteration, but certainly not complete deforestation. H. Miranda's studies on the Philippine Falconet showed that the species is not seriously threatened except on some of the smaller or medium-sized islands like Mindoro, Negros and Cebu. Population sizes and trends are generally unknown for the genus.

The falcons are the most intimately known members of the Falconidae. Population estimates have been made for many and because of their high profiles have attracted much attention, especially during the major pesticide period from the 1950's to 1970's. The species listed under CITES Appendix I are the Seychelles Kestrel (*Falco araea*), the Mauritius Kestrel, Laggard and Peregrine Falcons and the Gyrfalcon, as well as the possible Aldabra race *aldabranus* of the Madagascar Kestrel (*Falco newtoni*). Recent studies of the Seychelles Kestrel show it to be at carrying capacity on the islands of Mahé and Silhouette, and far more widespread and common than had been thought. It became extinct on Praslin, due primarily to human persecution, which was particularly favoured by its exceptional tameness. A century ago it was thought to occur on several other nearby granitic islands from which it is now absent. In 1981, a total of about 420 pairs was estimated for the islands. The possible subspecies of the Madagascar Kestrel that is confined to the atoll of Aldabra might have a population of about 100 birds. This species might be in a more serious state than some others, because its main population is on Madagascar where habitat degradation and human overpopulation are major problems. Nevertheless, the Madagascar Kestrel actually seems to have benefited from deforestation, and in 1982 it was estimated to number some 30,000-60,000 pairs. Definitely vulnerable, due to low numbers, are some distinctive island races of the Peregrine Falcon: those confined to the Cape Verde Islands and to the Volcano Islands, south



of Japan, may number only a handful of individuals; another race of Fiji, Vanuatu and New Caledonia is very rare, with perhaps only 100 breeding pairs, although it has probably never been much more numerous.

Some falcons are declining over considerable areas. The Lesser Kestrel, in spite of large numbers and a extensive range, is declining over much of the Western Palearctic for reasons that are not altogether clear, although habitat loss and the use of pesticides are probably the main causes. Also declining over most of its European range is the Lanner Falcon, and while pesticides are again thought to be one of the main causes, shooting and removal of birds for falconry constitute other important factors. The Saker Falcon has declined in central and south-east Europe because of a food shortage caused by habitat alterations, but the adaptability of the species may save it. Ground squirrel populations were so severely reduced in the Ukraine and Volga River Delta region that the Saker Falcon essentially disappeared as a breeder until it switched to a secondary staple food, the Rook (*Corvus frugilegus*). In addition, specific tree types in which Sakers typically nested were removed, another factor which hastened the decline; their recovery in the Ukraine was aided by their ability to take over unused stick nests of other species on high tension power poles, while in the Volga Delta region they began nesting in Rook colonies.

Other species are naturally rare, and some with small island populations where human numbers are increasing and habitat decreasing, may be under threat. The Orange-breasted, Grey and Taita Falcons seem to be in the category of naturally rare species. Until the past couple of decades, however, only a handful of Taita Falcon eyries were known in such scattered locations as Kenya, Mount Elgon in Uganda, the Shire Valley in Malawi and the Zambezi River gorge between Zambia and Zimbabwe. Now, several eyries are known on Mount Elgon and at least six within Zimbabwe, while the species has recently been found nesting in South Africa. Nonetheless, wherever studies have been made, researchers believe that when the Taita Falcon occurs alongside the Peregrine Falcon it is forced to accept less favourable cliff nest-sites, resulting in low nesting success. Apart from rareness possibly caused thus by competition with the Peregrine, the Taita Falcon is also under some threat through a proposed dam in one of its major known strongholds along the Zambezi River. As insurance against the loss of that population, it is now being bred in captivity for release into the wild, should this become appropriate.

Some 1000 pairs is the most current estimate for the little studied Grey Falcon. Its range has shrunk, probably due to habitat alteration, but its main habitat, the vast arid interior of Australia, is not under imminent threat, so that the falcon seems relatively secure in its rarity.

P. Jenny and colleagues have been studying the Orange-breasted Falcon since 1979, and 13 nesting sites were known to them by 1992. Certainly, fewer than 25 eyries have been found throughout its immense Neotropical range, and perhaps half of the known eyries occur in Belize. The habitat of this species, expansive unbroken canopy in climax forests, is under threat from a fast-growing human population, with the accompanying problems of logging, slash-and-burn agriculture and livestock grazing; by some estimates there might be no more than a few hundred to a few thousand birds left throughout the entire Neotropics.

The Banded Kestrel was considered rather common in some parts of Madagascar in the 1930's, but it may now be rare throughout much of the island, and indeed there may only be several hundred to 1000 pairs remaining. Fortunately, it seems not to be dependent for survival on the virgin forests in which it evolved, and in places it has now moved into cultivated land near second-growth forest, and also into degraded rain forest. Nevertheless, forests in Madagascar are so intensely degraded and habitat alteration is happening at such a rapid rate that the future of the kestrel can not be viewed with complacency.

There are five main ways in which humans have had direct impact on the status of different falconids, over variable periods of time: systematic persecution through shooting and trapping; egg-collecting; falconry; habitat conversion or alteration; and synthetic chemical biocides. While each of these factors has differed in importance through time and some may have had great local impact, only the latter two seem to have reduced breeding populations permanently, and even then, when biocides were banned, populations began to recover.

Systematic persecution seems to have been mainly important between the eighteenth century and the early twentieth century. Well chronicled histories were recorded primarily in the Northern Hemisphere, and while it is certain that many falconids were likewise persecuted elsewhere, for instance in South America and Africa, it seems that large hawks, eagles and vultures were probably the main targets. Much of the killing of falcons in Europe was by gamekeepers, or bounty-killing of what was regarded as "vermin" (see page 92). For example, on one estate in Glen Garry, in the highlands of Scotland, a gamekeeper reported that between 1837 and 1840, 98 Peregrine Falcons, 78 Merlins, and 462 Common Kestrels were killed. In Finland, in the period 1900-1960, rewards were paid on 35,267 falcons, with 84% of them killed before 1926. The list could go on and on for most European countries, and



Several caracaras are closely associated with man. In central Chile, for example, large numbers of Chimango Caracaras gather around shellfish processing factories, where they search in the heaps of discarded shells for scraps to feed on.

[*Milvago chimango*, Calbuco, Chile.
Photo: Isabel Martínez]

The Banded Kestrel is endemic to Madagascar, where it is found mainly in forest edge and woodland habitats. Although it is still locally common, it is currently declining, as a result of deforestation, and only limited amounts of suitable habitat now remain. In all, no more than 1000 pairs are thought to survive.

[*Falco zoniventris*, Madagascar.
Photo: O. Langrand/Bios]

Until recently, virtually nothing was known about the forest-falcons, mainly due to their very secretive nature; indeed, no nest of the genus was found until 1978. However, as a result of the Peregrine Fund's Maya Project in the Tikal National Park in Guatemala, much has now been discovered about two of the species, the Collared Forest-falcon, seen here, and the Barred Forest-falcon (*Micrastur ruficollis*). They are now known to be considerably commoner than was previously thought.

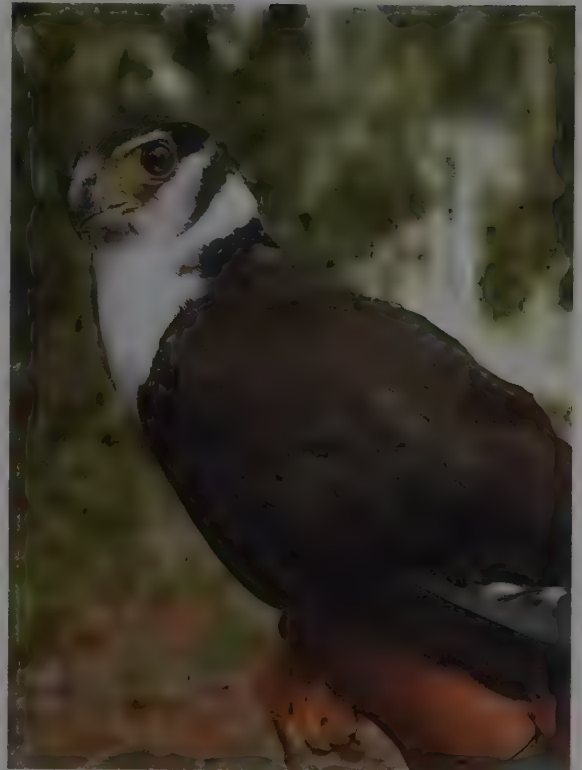
[*Micrastur semitorquatus*, Tikal, Guatemala. Photo: Craig J. Flatten]

North America had no better record. Thousands of falcons were killed during their concentrated migrations at Hawk Mountain, Pennsylvania (USA), even right through the 1930's, after it had been declared a sanctuary in 1934. The Peregrine Falcon was killed for bounty paid by racing pigeon fanciers in Tasmania as late as 1972, and about 50-100 were killed annually, many at the 100 or so eyries on the island. Though no legal or official bounty is offered, it is thought that about 10-20 Peregrine Falcons and 100 Brown Falcons are still trapped annually by pigeon fanciers in Tasmania. The systematic killing of falcons, as of other raptors, was partly a result of their being categorized as destructive, in most cases by what was known as the "usefulness principle". In 1867, in an ornithological publication that was almost a handbook of raptor destruction, special instructions were given on how owls might most effectively be used as lures in attracting and destroying Eurasian Hobbies, Peregrines, Merlins and kestrels. In 1874, the most important German ornithological journal urged the shooting of Eurasian Hobbies and Peregrine, Lanner and Saker Falcons, but suggested that the Common Kestrel should be excepted from the recommendation. The rate of deliberate killing is indicated by data from the period 1913-1962 in Finland where, of 2135 Common Kestrels ringed, with a 6% recovery rate, 53% were reportedly shot or killed in traps. Based on returns of rings, the rate of Prairie Falcons killed by humans up to 1979 was 65%.

A shift in public attitudes and perception toward falcons, starting in the 1950's, may have been an important factor in reducing persecution. In Britain, for example, the number of ringed falcons reportedly killed by man prior to 1954 and after 1954 were respectively, for the Common Kestrel from 41% down to 10%, for the Merlin from 52% down to 16%, and for the Peregrine Falcon from 56% down to 22%. Some falcons killed by humans may not have been reported as such, simply because of publicity against such acts after the 1950's. Fortunately, the systematic persecution and killing has stopped in most developed countries, with a few notable exceptions, such as Malta. It is hard to assess the long-term impact of such systematic persecution on populations, partly because some species have proved to be very resilient. This is illustrated by data on the killing of Peregrine Falcons in Britain during World War II, mainly between June 1940 and February 1946. Because Peregrines killed carrier pigeons with important messages for the war effort, the Secretary of State for Air signed the Destruction of Peregrine Falcons Order, in an attempt to reduce or eliminate the problem. Over 600 falcons were shot during that time, a good many of which were breeding pairs. Estimates are that the entire British population was reduced by about 13%, but some local populations were virtually eliminated. Once the killing stopped, recovery was rapid, and the species was well on its way back within 10 years.

However, as has been seen, direct persecution certainly eliminated the Guadalupe Caracara. Deliberate killing still occurs on a wide scale wherever people own firearms, especially in South America, Africa and Asia, but its effects are probably not generally as severe as in the past. Inadvertent killing goes on in numerous ways. For example, in 1992 it was discovered that perhaps 1000 Gyrfalcons are caught in fox traps annually in Yakutia, Siberia; extrapolating this across the Russian Arctic gives an estimated 2000 Gyrfalcons killed annually by fur trappers. In Australia, 21% of reported deaths of ringed Peregrine Falcons since 1971 were, rather surprisingly, due to collisions with automobiles. Indeed, collision with man-made objects, such as cars, powerlines, windmills and windows, is known to be a major cause of injury to falcons. Secondary poisoning, from poisons targeted at rodents, foxes and dingos in Australia, kills ground foragers, such as Brown Falcons, that are also active scavengers; secondary poisoning also affects some caracaras locally.

Egg-collecting was another of the practices to have a significant impact on falconids, and, in fact, ornithology was nearly synonymous with egg-collecting during the period 1870-1920. Falconid eggs are particularly desirable because of the beautiful mottling and flecking of shades of red, brown, cream



and white. Large falcon eggs had a particular monetary value and literally thousands of clutches were collected. In Dorset, England, the collector Arthur Blinn reportedly took 64 Peregrine Falcon eggs, amounting to about 20 clutches, in 1928 alone, and there is a well publicized picture of him with a coil of rope and a large pile of blown eggs on top of the Dorset cliffs. Again, however, the impact of egg-collecting was probably temporary, especially since habitat was not lost and breeding adults seldom killed in the process.

Falconry falls into much the same category, and its true effects on populations is unknown. Data from Iceland, gathered by O. Nielsen and G. Petursson, show that between 1731 and 1793 a total of 4848 Gyrfalcons were exported from Iceland to Denmark, and thence into the falconry community; of these birds, 4318 were grey local falcons from Iceland, and 530 white migrants from Greenland. Most of these birds were trapped or taken from nests in western Iceland, and as long as the population was healthy in other parts of Iceland (or Greenland, in the case of migrants), whence replacement birds could come, there seems to have been no permanent loss. Today, the Gyrfalcon population in western Iceland is at carrying capacity. Saker Falcons in the Middle East are particularly coveted, and by most estimates some 3000 are held in captivity in any given year. Based on information from 1982, however, there may be over 20,000 breeding pairs over the entire Eurasian range of the species, so at present the number trapped each year may not be too serious a percentage of the total population. Habitat and food resources for the Saker have decreased over the last two or three decades, especially in eastern Europe, and if the trend continues into the next two decades the situation for the Saker may change significantly.

One of the main factors adversely affecting many, probably most, bird species, and indeed most forms of wildlife throughout the world is the degradation and destruction of natural habitats. As the majority of falconid species are mainly associated with fairly open habitats, rather than closed forest, they are probably less affected by it than most other Falconiformes (see page 96). However, most of the forest-dwelling species and even some that inhabit open areas, notably the Lesser Kestrel, are in regression for this reason. Nevertheless, rather than straightforward destruction or conversion, the most serious way in which most falconids suffer from the impover-

ished habitats may well be through the contamination of the environment.

The organochlorine pesticides DDT and its most important metabolite, DDE, the cyclodienes dieldrin and heptachlor, and polychlorinated biphenyls, or PCB's, have all had serious effects on falconids. The major effects of these chemicals started in the late 1940's, and they reached a peak in the late 1960's and 1970's, although by this time most had been banned in developed countries. Their residues still linger on today, but not with the devastating effects of the 1960's and 1970's. They affect falconids in several different ways. Perhaps the most publicized effect is eggshell thinning, which is caused only by DDT: it can occur to such a degree, usually 17% thinning, that the eggs break. The two other main consequences are embryo deaths in contaminated eggs, and occasional adult mortality. In the Peregrine Falcon, the species most severely affected, a value of 15-20 parts per million of DDE (wet weight) was associated with 17% eggshell thinning and subsequent reproductive failure. Bat Falcons and American Kestrels respond at similar levels to Peregrines, but Prairie Falcons and Merlins are more sensitive. In Australia, three species still showed some eggshell thinning in the 1990's: the Australian Hobby with 2.4%; the Grey Falcon with 6.1%; and the Peregrine Falcon with 10% thinning, down from a maximum of 38% thinning in the 1970's. In Africa, eggshell thinning in the 1970's was as high as 22% in the Peregrine Falcon, but by the 1990's it had declined to about 10%, while the Lanner Falcon had comparable thinning and the Taita Falcon showed about half that amount of shell thinning. In the 1970's, South American Peregrine Falcons had about 15% shell thinning, and Crested and Chimango Caracaras, both omnivorous species, showed traces of DDE and PCB's. In Florida, USA, on the other hand, in the

1970's, the Crested Caracara showed levels of about ten times more DDE, although even these amounts were not deleterious. At the moment no species is known to be declining as a direct result of chemical contamination.

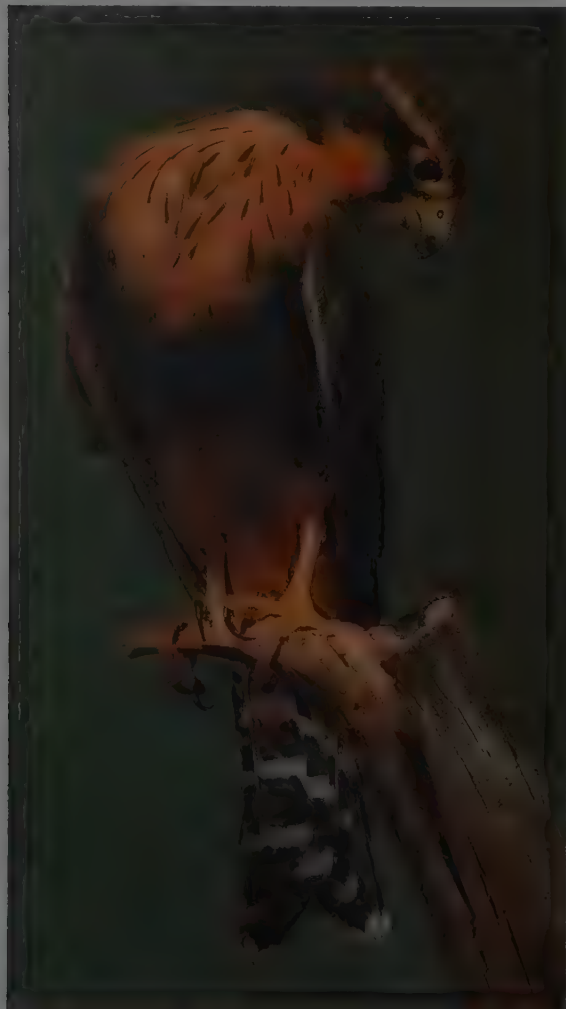
Two of the most successful stories in avian conservation biology have been centred on the Mauritius Kestrel and Peregrine Falcon. In the 1850's the Mauritius Kestrel was said to be plentiful wherever the indigenous woods remained. Because of the small size of the island, in conjunction with the territory size of the species, even at the best of times the peak population was thought probably not to number more than a few hundred birds; indeed, in 1982 the highest estimate available put carrying capacity at 328 pairs. The species declined over the decades as a result of habitat alterations and a few other factors, and by 1960 it was thought that only 10 pairs remained. At its lowest population level, at the start of the 1970's, only a single pair and two solitary birds could be found. The total number was unknown, but almost certainly there were more, because in 1973 at least nine birds could be accounted for. During the 1970's, some were taken into captivity for breeding, but success was limited. At the start of the 1980's, all six kestrels in captivity in Mauritius died, while the wild population was estimated to be only 15 birds. However, since the late 1980's captive-bred young, reared both in Mauritius and at Boise, Idaho (USA), have been released into the wild each year, with the 300th released in November 1993. As a direct result of this bolstering, by the 1992-1993 breeding season 45 territorial pairs were known, while 50-55 pairs were suspected, with a floating population of roughly one bird per pair. In November 1993, 50 wild pairs were counted and about 10-15 more were estimated, with perhaps 215-240 birds living in the wild. Aerial photographs of Mauritius taken in 1993 showed there to be over 300 km² of possible habitat for kestrels on the island. In all, it was estimated that the habitat could hold a minimum of 150 territorial pairs, and allowing for pairs in marginal habitat and non-breeding birds, a total population might reach 500-700 kestrels. This is about twice the 1982 estimate for the original population size at carrying capacity. Much of this increase was possible because rather than being tied to native forests as was originally thought, young birds were released into a variety of alien habitats, including open exotic savanna, river valleys, and fragmented native forests, and in such areas they have become successfully established; one pair even lives in a village. The adaptability of the species in capturing a wider range of prey, and in broadening habitat preferences has proved to be greater than thought. Nevertheless, as a warning regarding the cases of all such island endemics, it is worth noting that there is evidence that, like neighbouring islands, Reunion too probably had its own endemic kestrel species; it seems that this form was probably wiped out when the early European settlers arrived, without a specimen ever reaching the hands of a scientist.

Peregrine Falcons were exterminated in the eastern half of the USA and adjacent southern Canada by about the mid-1970's. Many of the countries in Western Europe, such as Belgium and Luxembourg, lost their populations too. From an overall perspective, losses were spotty and sometimes regional, although the extent of loss was largely unknown over vast regions of Asia and through Indonesia. Numbers were at their lowest and declines at their most severe in Western Europe between the mid-1960's and the mid-1970's, though the peak of the decline varied regionally. Some examples of Northern Hemisphere declines were: a 66% decline in Britain; 84% in Austria; about 98% in Fennoscandia and West Germany; 100% in East Germany; about 85% in the western USA; and 100% in the eastern USA. Once the use of chemicals was limited or banned in the 1970's, the species increased again, as shown by some figures from the mid-1980's, for instance a 62% increase in Austria, 50% in Fennoscandia, and 100% increase in France and Switzerland. By 1993, there had been a sharp increase in most localities in Europe and North America.

There are impressive examples of both natural and man-assisted recoveries of this species in both North America and

The widespread Aplomado Falcon is one of several falcon species that appears to have benefited in many areas from the effects of deforestation, as this has opened up new zones for it to colonize. Despite this general tendency, the species has undergone a major decline in the north of its range which is probably connected with the use of dangerous pesticides. The species is now the object of a captive breeding and reintroduction programme in the USA.

[*Falco femoralis*.
Photo: R. Austing/FLPA]



The Mauritius Kestrel is the subject of one of the greatest of all conservation successes. The species underwent a catastrophic decline, largely due to habitat alteration, and by the early 1970's only four birds could be found in the wild, although there must have been at least a few more. Captive breeding was initiated around this time with great success, and this was then followed up with reintroductions. By 1993 the total population in the wild was reckoned to be in the region of 215-240 birds.

[*Falco punctatus*, Moka Mountains, Mauritius.
Photo: Nick Garbutt/
Planet Earth]



Europe. In Norway there was a sharp decline from 500-1000 pairs around 1900 to less than 10 known in 1975. Following the ban on the offending chemicals, there was then a modest recovery to over 50 pairs in 1985, and 150-200 by 1992. For Great Britain, an estimated pre-1940's population of 650 pairs declined to about 450 pairs in 1971, but by 1991 there were an estimated 1200 pairs. By 1993, populations of the Yukon River, Alaska, had increased by 175% over their lowest levels, and those of the Colville River, Alaska, increased about 300% over their lowest level; these values are actually more than 50% above known historical levels. In 17 western states of the USA, the 607 pairs known in 1992 were twice that deemed necessary for downlisting from an endangered to a threatened status, and almost twice the 322 historically known pairs. Much of this increase was natural but more than 2451 captive-bred Peregrines had been released by The Peregrine Fund alone up to 1992. In the eastern USA, where the species had become extinct by the 1970's, over 99 pairs had been established by 1992 by means of reintroduction, with the release of 1229 captive-bred falcons; about 275 pairs were known historically. Some 34 pairs have been established in the central USA and extreme south central Canada, with 667 falcons released in the USA sector by several groups up to 1992. Additionally, Canada released 563 Peregrines in 1976-1987 in the provinces between Alberta and Quebec. By 1983 the tundra subspecies *tundrius* was proposed for downlisting from endangered to threatened in the USA, and by 1993 it was ready for removal from the threatened list; in Canada, *tundrius* was downlisted from threatened to vulnerable in 1992. Although eggshell thicknesses are not back to normal, they are generally 4-5% better than the critical 17% thinning level at which eggs break. Thus, the story of the Peregrine Falcon is one of success following two deliberate and conscious actions of man: the banning of pesticides; and, for parts of North America and Europe, the release of large numbers of captive-bred falcons.

In conclusion, there seem to be two important threats facing members of the Falconidae at the population level: habitat alteration; and the continued presence of synthetic organochlorines in the environment. Habitat alterations, especially the removal of primary forest at the rate it is presently occurring, is likely to have major effects on forest-

falcons and the Laughing Falcon, and perhaps also falconets and some kestrels. Most habitat alteration, however, will probably not have much effect on hobbies, most kestrels and some caracaras. The pesticide story is far from over, however, in spite of the great strides made over the past two decades. Eggshell thinning occurs to some degree in most of the Peregrine Falcon populations examined, even in the remote islands of Fiji, and in many other falcon species, as well. The sort of chemical pollution that occurred in the past does not seem to have major effects on caracaras and some falcons, whereas other falcons are probably still at high risk. However, nobody can predict what new chemicals will appear on the market, and, perhaps of equal importance, the critical threshold of most species of falconids to chemicals has not yet been established. The levels of dangerous chemicals currently in the environment may be sufficient to affect particularly sensitive species that have not yet come into contact with them.

In addition to other projects, the Peregrine Fund is releasing captive-bred Aplomado Falcons in the northern part of their range, in the USA and northern Mexico, where they were extirpated earlier in the present century. In 1993, 26 young falcons were released, and while 23 were known to have survived to winter it is too early to know how successful the programme will be. No species of falcon need go extinct if proper management techniques are applied and concerned citizens are apprised of the problems facing falcons.

General Bibliography

- Amadon & Bull (1988), Anon (1983), Burton & Houston (1993), Boyce & White (1987), Brown (1976a), Brown & Amadon (1968), Burton & Boyer (1989), Cade (1982), Chancellor (1977), Chancellor & Meyburg (1986, 1991), Cooke *et al.* (1982), Griffiths (1994), Grossman & Hamlet (1964), Hakkarainen *et al.* (1993), Helbig *et al.* (1994), Hill (1944), Jollie (1977), Kemp & Crowe (1990, 1991, 1993), Meyburg & Chancellor (1989, 1994a), Newton (1979, 1985c), Newton & Chancellor (1985), Newton & Olsen (1990), Olsen & Cockburn (1991, 1993), Olsen *et al.* (1989), Olson (1985), Rutgers & Norris (1970), Seibold *et al.* (1993), Sibley & Ahlquist (1990), Sibley & Monroe (1990), Sibley *et al.* (1988), Stresemann & Amadon (1979), Weick (1980), Whitacre & Thorstrom (1992).



Subfamily POLYBORINAE

Genus *DAPTRIUS* Vieillot, 1816

1. Black Caracara

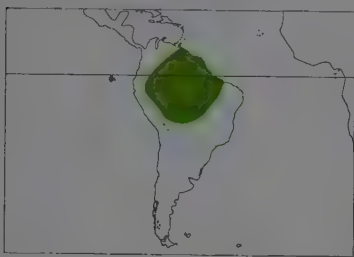
Daptrius ater

French: Caracara noir German: Gelbkehlkarakara Spanish: Caracara Negro
Other common names: Yellow-throated Caracara

Taxonomy. *Daptrius ater* Vieillot, 1816, Brazil.

May merit generic differentiation from *D. americanus*, due to differences in morphology, habitat and behaviour. Monotypic.

Distribution. E Colombia, S Venezuela and the Guianas S through Amazonia to E Peru, NE Bolivia and C Brazil (Maranhão, N Mato Grosso).



Descriptive notes. 41-47 cm; 330-354 g. All glossy black; tail basally white; bare skin of face orange, of throat yellow; iris reddish brown, legs pale orange yellow. Tail pattern and all black underparts separate from *D. americanus*. Immature duller black; spotted or barred buff below; basal two thirds of tail white with 3-4 black bars; iris brown, face dull yellow.

Habitat. Forest, usually near edge or along rivers; wooded savanna, gallery forest, sometimes in mangroves; frequents areas that have been burnt. Absent from areas of apparently suitable habitat in French Guiana.

Food and Feeding. Omnivorous, feeding on carrion, frogs, fish, nestling birds, mammals, dragonflies, spiders, beetle larvae, maggots and ants; fruits, e.g. of palms (*Mauritia flexuosa*, *Eleais*, *Desmoncus*), found in stomachs. Picks ticks off tapirs and deer; on hearing species, tapirs said to call, in order to attract the birds, then lie down while the caracaras pick off ticks. Usually alone or in pairs, but, like *D. americanus*, also often in flocks of up to 7-8 birds.

Breeding. No nests have been described, but in Guyana species said to nest in trees, laying 2-3 eggs in Mar-Jun.

Movements. Nothing known; presumably sedentary.

Status and Conservation. Not globally threatened. CITES II. Status very poorly known. Extensive range and catholic taste in terms of habitat and feeding habits suggest species relatively secure. Generally fairly common in suitable habitat in Colombia; locally common in parts of Amazonian Ecuador.

Bibliography. Blake (1977), Dubs (1992), Friedmann & Smith (1950), Griffiths (1994), Haverschmidt (1962), Hilty & Brown (1986), Meyer de Schauensee & Phelps (1978), Ortiz & Carrión (1991), Pinto (1964), Remsen & Traylor (1989), Ruschi (1979), Sick (1985a, 1993), Snyder (1966), Thiollay (1985a, 1989a), Tostain *et al.* (1992), Traylor (1958), Voous (1969), Vuilleumier (1970).

2. Red-throated Caracara

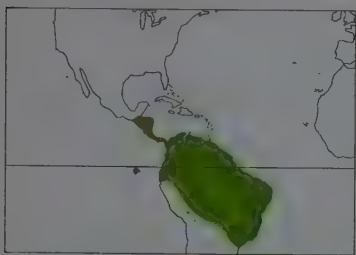
Daptrius americanus

French: Caracara à gorge rouge German: Rotkehlkarakara Spanish: Caracara Gorgirrojo

Taxonomy. *Falco americanus* Boddaert, 1783, Cayenne.

May merit separation from *D. ater* in genus *Ibycter*, on grounds of differences in morphology, habitat and behaviour. Populations from Central America and SE Brazil have been recognized as races *guatemalensis* and *pelzelni* respectively, based primarily on size, but substantial overlap with intervening populations. Monotypic.

Distribution. Extreme S Mexico (Chiapas) S to Colombia, S on Pacific slope to W Ecuador, and E of Andes to C Peru, N & E Bolivia and S Brazil (NW Paraná, Mato Grosso and São Paulo).



Descriptive notes. 48-61 cm; 510-680 g. Mostly glossy black; belly, thighs and undertail-coverts white; facial skin and unfeathered throat red, bordered obscurely with whitish; iris brown to deep red, legs and feet bright orange red. Tail pattern and white on underparts separate from *D. ater*; also has blunter wings and bulkier head. Immature has bare skin more yellowish; sides of face and throat black.

Habitat. Primary rain forest from tropical lowlands up to subtropical zone; dry deciduous forest in Venezuela; *cerrado* in Brazil. Normally occurs in groups of 5-7 individuals, but up to 9-10; smaller groups recorded in logged

forests, but species does not frequent heavily disturbed second-growth forest.

Food and Feeding. Mostly eggs and larvae of wasp and bee nests, amounting to 74% of prey items recorded in a forest in French Guiana; also some hard fruits, including palms; other miscellaneous invertebrates and turtle eggs. Most bee and wasp nests attacked are small (4-20 cm in diameter); no records of ant or termite nests attacked. Groups of birds move in saltatory, apparently random fashion through territory, most of the birds feeding in understorey, while two remain in canopy, perhaps as sentinels. Allofeeding (with different adults feeding each other) recorded, in one case when large nest was found. Despite bare face and throat, with no physical protection from wasps, normally aggressive wasps never attack species, even when feeding on the wasps' colony; wasps stay 1 m away from caracara, suggesting species may have some sort of repellent which protects it; may be unique in animal world. Oropendolas, parrots, toucans, some large cotingas and woodpeckers associate with caracara flock, apparently taking advantage of sentinel behaviour to forage well below canopy in strata of forest in which they are otherwise rarely if ever seen; some individuals of these other species follow caracara group for hours.

Breeding. In Colombia, birds in breeding condition in Jul; in Panama, one about to lay in Mar. Stick nest; one in French Guiana was hidden 22 m up in vine-covered tree. 2-3 eggs. Has complex, stable social structure almost unique among birds of prey. Groups apparently hierarchical, highly territorial and faithful to territory over long periods, at any rate for 5 years. Only group studied in any detail defended territory of 400-450 ha in French Guiana. Apparently only 1 breeding attempt in 5 years. One or 2 birds always near nest, defending it aggressively. Groups very vocal in defending territory, and rely on vocalizations to maintain group cohesion. When another member of flock arrived with wasp nest, one of sentinels left nest area to forage, leaving recent provider on guard duty; up to 4 individuals seen sequentially delivering prey to nest.

Movements. Sedentary. Groups defend territories all year round.

Status and Conservation. Not globally threatened. CITES II. Populations of Panama, and perhaps much of Central America, have declined dramatically since 1950's and 1960's, in part due to deforestation, but also in areas where extensive forest remains; no recent records in N of Costa Rica; has declined greatly on Caribbean slope of Panama, where now rare. Occurs in many forest areas of South America at population densities perhaps surpassed by other tropical forest raptors only by some forest-falcons (*Micrastur*). Average density of at least c. 200 individuals/10,000 ha reported in French Guiana.

Bibliography. Blake (1977), Davis (1972), Dubs (1992), Friedmann (1950), Friedmann & Smith (1955), Griffiths (1994), Haverschmidt (1962), Hilty & Brown (1986), Land (1970), Lowery & Dalquest (1951), Meyer de Schauensee & Phelps (1978), Monroe (1968), Pinto (1964), Remsen & Traylor (1989), Ridgely & Gwynne (1989), Ruschi (1979), Sick (1985a, 1993), Skutch (1959), Slud (1964), Snyder (1966), Stiles & Skutch (1989), Straube & Bornschein (1989), Terborgh & Weske (1975), Thiollay (1989a, 1991b), Tostain *et al.* (1992), Voous (1969), Vuilleumier (1970), Wetmore (1965).

Genus *PHALCOBOENUS* d'Orbigny, 1834

3. Carunculated Caracara

Phalcoboenus carunculatus

French: Caracara caronculé German: Streifenkarakara Spanish: Caracara Carunculado

Taxonomy. *Phalcoboenus carunculatus* Des Murs, 1853, Colombia.

Formerly treated as race of *P. megalopterus*, as was *P. albogularis*; these three form superspecies, in which some authors also include *P. australis*. Genus closely related to *Polyborus*, and sometimes even merged with it. Monotypic.

Distribution. Andes of Ecuador and SW Colombia.



Descriptive notes. 50-56 cm; wingspan 110 cm. Mostly glossy black, but boldly patterned with white streaks on breast; underwing, lower belly, undertail-coverts and tip of tail all immaculate white; crown with moderately apparent, curled crest. Iris hazel to blackish grey, cere and bare skin of face and throat bright orange to deep red; throat skin wrinkled forming wattles (caruncles); feet and legs bright yellow. Pattern on underparts separates from congeners. Immature tawny to fuscous brown with dark shaft streaking; head, rump and underparts with some white mottling; legs and feet dusky.

Habitat. Treeless areas of upper temperate

zone, at 3000-4000 m; in páramo or grassy pastures with scattered bushes.

Food and Feeding. Worms, maggots, small rodents, birds, lizards, vegetable matter; said to take almost anything edible. Considerable local variation (see page 230). Feeds mainly on the ground by scavenging; often walks or runs about. Groups of up to 8 (or perhaps even 40) individuals seen feeding together, typically in vicinity of cattle.

Breeding. Eggs Sept-Oct; fledging Jan, but one well developed nestling collected in late May. Nests on cliffs with somewhat more substantial nest than *P. megalopterus*; 1 nest on pine tree.

Movements. Presumably sedentary. Outside breeding season, may gather in flocks of 100+ birds.

Status and Conservation. Not globally threatened. CITES II. Uncommon to locally common; in Colombia, commonest in Cumbal area of S Nariño, near border with Ecuador; currently spreading into Cauca valley. In Ecuador, common in páramo zones around Mt Antisana, and fairly common in some other protected areas. Probably relatively secure at present, as habitat not under significant pressure; no reports of persecution.

Bibliography. Amadon (1964), Blake (1977), Ejlsdå & Krabbe (1990), Hilty & Brown (1986), Ortiz & Carrión (1991), de Vries *et al.* (1983), Vuilleumier (1970).

4. Mountain Caracara

Phalcoboenus megalopterus

French: Caracara montagnard German: Bergkarakara Spanish: Caracara Andino

Taxonomy. *Aquila megaloptera* Meyen, 1834, Cordillera of Chile.

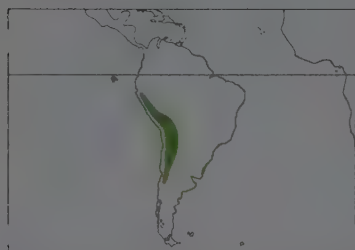
Formerly considered to include *P. albogularis* and *P. carunculatus* as races; these three form superspecies, in which some authors also include *P. australis*. Possible hybrids with *P. albogularis* reported. Monotypic.

Distribution. Andes from N Peru (Piura), through Bolivia to NW Argentina and C Chile (Colchagua).

Descriptive notes. 48-54 cm; c. 795 g. Glossy black, with belly to undertail-coverts and underwing-coverts pure white; as in congeners, primaries narrowly tipped white, tail with broader white tip. Iris brown, bare facial skin reddish orange or red, legs and feet orange-yellow. Pattern on underparts separates from congeners. Immature tawny to fuscous brown; very similar to immature *P. carunculatus*, but without rufous barring on upper tail-coverts; dusky legs and feet.

Habitat. Treeless areas of upper temperate zone, typically in puna; generally at 2000-4000 m, but in Chile occasionally down to 1000 m. Breeds and roosts in rugged country near cliffs; for feeding, moves into flatter country, especially puna grassland, often near lakeshores.

Food and Feeding. Large arthropods, young rodents or birds; also carrion and rubbish. Often gathers, in numbers near towns, to feed on carrion and refuse; fills niche of large Corvidae in comparable N



Hemisphere habitat. A strong flier, but all feeding seems to be done on foot, with bird scratching or stomping to disturb insects; like some of its congeners, a most atypical raptor.

Breeding. Eggs in Oct-Nov in S of range. Nests on cliffs; most reports indicate nests often nothing more than a bit of cow dung, but some nests observed on concrete electricity towers were more substantial, made of large sticks with llama's or sheep's wool worked into nest. Usually 2 eggs, sometimes 3.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES II. A common bird in suitable

habitat; of no conservation concern. Abundant in N Altiplano of Peru and Bolivia.

Bibliography. Amadon (1964), Blake (1977), Fjeldså & Krabbe (1990), Housse (1938), Jaksic & Jiménez (1986), Johnson (1965), Parker *et al.* (1985), de la Peña (1992), Remsen & T aylor (1989), Vuilleumier (1970), White & Boyce (1987), Wolfe (1951), Zimmer & Osgood (1930).

5. White-throated Caracara

Phalcoboenus albogularis

French: Caracara à gorge blanche **German:** Weißkehlikarakara **Spanish:** Caracara Araucano
Other common names: Darwin's Caracara

Taxonomy. *Polyborus (Phalcoboenus) albogularis* Gould, 1837, Santa Cruz, Patagonia.

Formerly treated as race of *P. megalopterus*, as was *P. carunculatus*; these three form superspecies, in which some authors also include *P. australis*. Possible hybrids with *P. megalopterus* have been reported. Monotypic.

Distribution. S Chile (Ñuble) and S Argentina (S Mendoza) S to Tierra del Fuego.

Descriptive notes. 49–55 cm; wingspan c. 120 cm. Weak crest; somewhat less glossy black above than congeners, with uppertail-coverts and tip of tail white; all white below from chin to undertail, and on underwing-coverts; base of primaries banded black and white from below; facial skin yellow-orange, iris hazel, legs and feet yellow. White underparts separate from congeners. Immature may be indistinguishable in the field from immature *P. megalopterus*, but has weaker crest and is darker above; larger than *Milvago chimango*, with smaller pale areas in wings and tail.

Habitat. Open mountain slopes and humid

forest, including beech (*Nothofagus*) forest; up to 3000 m in N of range, down to sea-level in S.

Food and Feeding. Virtually no information available; food probably similar in general to that of *P. megalopterus*; known to take carrion e.g. dead guanaco. Usually solitary, but seen in small groups with vultures at carcasses; on Isla Grande (Tierra del Fuego), gathers in numbers at rubbish dumps, or sites where sheep slaughtered.

Breeding. Eggs probably laid in Oct–Nov. Builds stick nest on rock ledge. 2–3 eggs.

Movements. No information available.

Status and Conservation. Not globally threatened. CITES II. Indeterminate, said to be common in *Nothofagus* beech forest. Common at rubbish dump near Ushuaia (S Tierra del Fuego), but occurs at very low density in forests of adjacent national park. Habitat not subject to much disturbance, and no persecution reported, so presumably not a species of immediate concern.

Bibliography. Amadon (1964), Blake (1977), Clark, R. (1986), Fjeldså & Krabbe (1990), Goodall *et al.* (1957), Humphrey *et al.* (1970), Jaksic & Jiménez (1986), Johnson (1965, 1972), Koepcke (1970), de la Peña (1992), Vuilleumier (1970)

6. Striated Caracara

Phalcoboenus australis

French: Caracara austral **German:** Falklandkarakara **Spanish:** Caracara Austral
Other common names: Forster's Caracara, Johnny Rook

Taxonomy. *Falco australis* Gmelin, 1788, Staten Island.

Sometimes considered to form part of the *P. megalopterus* superspecies, but apparently more distinctive than congeners. Monotypic.

Distribution. Islets off extreme S South America, including Staten (Isla de los Estados), Navarino and Cape Horn, and Falkland Is; irregularly to S & E coasts of Isla Grande, Tierra del Fuego.

Descriptive notes. 53–65 cm; c. 1187 g. Black to brownish black overall; upper back, neck and breast streaked with white or tawny; tail broadly tipped white; underwing-coverts and thighs bright rusty rufous; white patch at base of primaries. Facial skin salmon pink to yellowish orange, iris brown, legs and feet bright orange-yellow. Largest *Phalcoboenus*; rufous thighs separate from congeners. Immature takes at least 5 years to reach full adult plumage; starts all black or blackish brown, and gradually attains streaking; facial skin, feet and legs pale grey.

Habitat. Open lowlands, from tidal zone per-

haps to low coastal mountains; most typically along rocky coasts.

Food and Feeding. Dead adults and chicks of colonial seabirds, when these are actively breeding. Scavenges in colonies of penguins, albatrosses, etc., not known to kill healthy chicks. While seabirds away from their colonies, present species scratches for insects and grubs along tidal zone. Will attack weak or stranded shore.

Breeding. In Falkland Is, hatching in Dec. Builds modest nest of dried grass, lined with wool when available, on rock ledge or under tussock of grass. Usually 2 eggs (1–4). Loosely colonial; nests can be as close as 6–7 m apart.

Movements. Not migratory, but may move seasonally up into coastal mountains. On N coast of Navarino I, and S & E coasts of Tierra del Fuego, may occur only as winter visitor.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Rare overall. Heavily persecuted in past on main Falkland Is. due to its attacks on weak or stranded sheep; bounty paid for its destruction, leading to extinction from East Falkland I; now mostly restricted to smaller islands of the group, especially in W, where reported to be locally numerous. May be similarly numerous on small islands near Cape Horn; surveys desirable.

Bibliography. Blake (1977), Cawkwell & Hamilton (1961), Clark, R. (1986), Cobb (1933), Fjeldså & Krabbe (1990), Humphrey *et al.* (1970), Jaksic & Jiménez (1986), Johnson (1965), Meyburg (1986), de la Peña (1992), Vuilleumier (1970), Wallace, G.E. (1991), Woods (1988).

Genus *POLYBORUS* Vieillot, 1816

7. Crested Caracara

Polyborus plancus

French: Caracara huppé **German:** Schopfkarakara **Spanish:** Caracara Carancho
Other common names: Common Caracara; Guadalupe Caracara (*lutosus*)

Taxonomy. *Falco plancus* J. F. Miller, 1777, Tierra del Fuego.

Recent proposal to replace traditional genus name *Polyborus* with *Caracara* on grounds of indeterminate type description, but *Polyborus* should be retained (see page 219). Closely related to *Phalcoboenus*, and less closely to *Milvago*, both of which genera sometimes included within *Polyborus*. Extinct form *lutosus* of Guadalupe I (off W Mexico) frequently treated as full species, but now generally considered a race of *P. plancus*. Race *audubonii* of doubtful validity, and often merged with *cheriway*; race *ammophilus* described from W Mexico, but even more dubious, and normally included within *audubonii*. Four extant subspecies usually recognized.

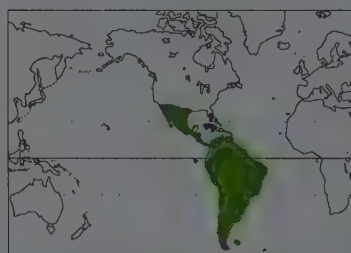
Subspecies and Distribution.

P. p. pallidus Nelson, 1898 - Tres Marias Is, off W Mexico.

P. p. audubonii Cassin, 1865 - S USA (Florida; Texas to Arizona) through Central America to W Panama; Cuba, I of Pines

P. p. cheriway (Jacquin, 1784) - E Panama through C & E Colombia to the Guianas and S to N Peru and R Amazon; Aruba (Netherlands Antilles) E to Trinidad.

P. p. plancus (J. F. Miller, 1777) - C Peru and C Bolivia E to Amazon Delta and S to Tierra del Fuego; Falkland Is.



Descriptive notes. 49–59 cm; male averages 834 g, female 953 g, in Panama, but species averages 1150–1600 g in Chile and Peru; wingspan 120–132 cm. Black cap and crest; bare face red; throat and neck white or buff; mantle pale white to brownish, streaked brownish black, with rest of back brownish to black, finely barred whitish; rump and tail whitish, finely barred black, with black tip to tail; creamy white vent. In flight, from above primaries show conspicuous whitish patch at base. Iris dull yellow or brown, long legs and feet yellow. Immature browner, with breast and back streaked or blotched whitish; bare parts

duller. Races separated on size, and extent of barring on nape, upper belly, vent and upperwing-coverts; *pallidus* similar to *audubonii*, but slightly smaller; extinct *lutosus* generally paler, with extensive barring on underparts, back and upperwing-coverts.

Habitat. Open and semi-open country; pastures, palm savannas, river edges and especially ranch land, e.g. in llanos; sometimes in forested and marshy areas. Mainly in lowlands, but increasingly in upland areas of Colombia and Ecuador; in Argentinian Patagonia, frequents grassy foothills, shrub-steppe and river valleys. Widely distributed in lowlands of Bolivia, but one juvenile seen, associated with juvenile *Phalcoboenus megalopterus*, at 3800 m.

Food and Feeding. Opportunist. Feeds mainly on carrion, roadkills, livestock and dead or dying fish. Also takes some live prey, including freshwater turtles, iguanas, geckos, snakes, crabs, earthworms, Curculionidae and other Coleoptera, and larvae of Lepidoptera; 3–4 individuals seen chasing and killing egret. Plunders nests of small birds and colonies of egrets and spoonbills; even nests of other caracaras (*Milvago*). Feeds on coconut flesh at harvest time on plantations in Guyana. Spends much time on ground. Seen wading in shallow water peering under vegetation, perhaps looking for frogs. Pirates food from other caracaras, other raptors and even pelicans. Pursues vultures in flight until they regurgitate, catching regurgitated food before it reaches ground. Dominant over individual Turkey Vultures (*Cathartes aura*) and American Black Vultures (*Coragyps atratus*) at carcass, but usually arrives at carcass early, before vultures are soaring and before they arrive at food.

Breeding. Season prolonged, sometimes with second clutch in same year; nesting Sept–May in Colombia and Venezuela (mostly dry season in latter); laying Jan–Feb in Florida (USA); Dec in Paraguay and Tierra del Fuego; in Argentina, nest building as early as Mar, eggs Jul–Oct. Nest large, c. 80 cm wide, c. 30 cm deep; dishevelled structure of sticks, with or without lining, on top of palm or cactus, in dense tangle of branches on tree, or on ground. Usually 2 eggs (1–3, rarely 4); incubation c. 28–32 days; chicks have pinkish buff down, darker brown on crown and back; fledging period prolonged, perhaps lasting c. 3 months.

Movements. Generally sedentary; possibly some local movements, as species most common along R Paraguay in Jun, and also common in Oct. Transient throughout year in highlands of W Guatemala.

Status and Conservation. Not globally threatened. CITES II. Fairly common to locally abundant. Locally persecuted in some farming regions (e.g. in S Chile) as accused of preying on lambs; declines reported in S Argentina in areas where strychnine used by sheep ranchers. Conversion of farmland to citrus plantations, and other forms of habitat loss, threaten Florida population. Elsewhere, conversion of forest to cattle pastures almost certainly beneficial to species, and range probably expanding. Form *lutosus* became extinct around 1900, as result of heavy persecution, mainly by shooting, often when birds gathered at water-holes.

Bibliography. Amadon (1954, 1964), Banks & Dove (1992), Blake (1977), Cabot & Serrano (1986), Contreras *et al.* (1990), Donazar, Ceballos *et al.* (1993), Ehrlich *et al.* (1992), Fjeldså & Krabbe (1990), Glazener (1964), Haverschmidt (1947), Hayes (1991), Hilty & Brown (1986), Humphrey *et al.* (1970), Jaksic & Jiménez (1986), Johnson (1990), Johnson (1965, 1972), Mader (1981), Marchant (1960), Menner (1968), Morrison (1993), Olrog (1979), Palmer (1988), de la Peña (1992), Pinto (1964), Richmond (1976), Ridgely & Gwynne (1989), Rivera-Rodriguez & Rodriguez-Estrella (1993), Rodriguez-Estrella & Rivera-Rodriguez (1992), Ruschi (1979), Siek (1985a, 1993), Shud (1964), Snyder & Snyder (1991), Stiles & Skutch (1989), Thiollay (1980b), Thomas (1979), Tostain *et al.* (1992), Vannini (1989), Vuilleumier (1970), Wallace, G.E. (1991), Wallace, M.P. & Temple (1987a), Wetmore (1965)

Genus *MILVAGO* Spix, 1824

8. Yellow-headed Caracara

Milvago chimachima

French: Caracara à tête jaune **German:** Gelbkopfkarakara **Spanish:** Caracara Chimachima
Other common names: Chimachima Caracara

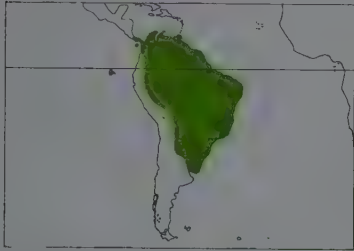
Taxonomy. *Polyborus chimachima* Vieillot, 1816, Paraguay.

Genus related to *Polyborus* and *Phalcoboenus*, and has been included in former; closest of the caracara genera to *Falco*. Despite some areas of overlap, may be regarded as forming superspecies with *M. chimango*. Two subspecies recognized.

Subspecies and Distribution.

M. c. cordatus Bangs & Penard, 1918 - S Costa Rica and Panama (including Pearl Is) through Colombia to the Guianas and Trinidad and S (E of Andes) to Amazon.

M. c. chimachima (Vieillot, 1816) - E Bolivia and Brazil S of Amazon to Paraguay, N Argentina and Uruguay.



Descriptive notes. 40-45 cm; male averages 315 g, female 335 g; wingspan 74 cm. Head, neck and underparts, including underwing-coverts, buff to creamy yellowish white; dark streak behind eye; back blackish brown; rather long, rounded tail and uppartail-coverts buff with dusky bars; tail with black subterminal band. In flight, conspicuous whitish patch at base of primaries. Iris reddish brown, bare skin around eyes bright yellow, legs pea green. Immature browner above, below streaked with brown. Race *cordatus* has head and underparts darker buff, and narrower tail bars.

Habitat. Open country with scattered trees, ranchland, pastures, palm savannas, forest edge and along rivers; up to c. 1800 m in Colombia, and recently recorded at 3600 m in Ecuador.

Food and Feeding. Omnivorous: carrion, from small roadkills to dead crocodiles; insects, including many caterpillars; frogs and toads; fish; birds' nests; fruits of oil palm (*Elaeis*); maize; and horse dung. Often walks about on ground. Perches on cattle to pick off ticks; picks flesh from open wounds on backs of cattle, which often seem oddly indifferent to the process.

Breeding. Season appears to be protracted: Aug (wet season) in Venezuela; laying in May in Guyana; Sept in S Brazil. Stick nest, usually high in tree, often on palm; where trees not available, nests on mounds in marshy areas, or amongst thistles in *pampas*. 1-2 eggs. No further information available.

Movements. No evidence of any movements.

Status and Conservation. Not globally threatened. CITES II. Widespread and very common. Perhaps colonizing deforested highlands in Andes, and will certainly move into lowland areas as they are converted from forest to cattle ranches or to small or to medium-scale farming.

Bibliography. Blake (1977), Clark, R. (1986), Contreras *et al.* (1990), ffrrench (1985), Fjeldsá & Krabbe (1990), Haverschmidt (1962), Hilty & Brown (1986), King, J.R. (1989), Mader (1981), Meyer de Schauensee & Phelps (1978), de la Peña (1992), Pinto (1964), Ridgely & Gwynne (1989), Ruschi (1979), Sick (1985a, 1993), Snyder (1966), Stiles & Skutch (1989), Tostain *et al.* (1992), Voous (1969), Vuilleumier (1970), Wetmore (1965), Woods (1988), Young (1925).

9. Chimango Caracara

Milvago chimango

French: Caracara chimango **German:** Chimangokarakara **Spanish:** Caracara Chimango
Other common names: Chimango (Hawk)

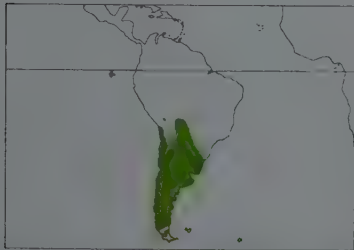
Taxonomy. *Polyborus chimango* Vieillot, 1816, Paraguay and Río de la Plata.

May form superspecies with *M. chimachima*; has been placed (with *M. chimachima*) in *Polyborus*. Birds of Tierra del Fuego sometimes awarded separate race, *fuegiensis*. Possible race *azarae* normally included within nominate. Two subspecies recognized.

Subspecies and Distribution.

M. c. chimango (Vieillot, 1816) - N & C Chile and N & C Argentina through Paraguay to Uruguay and adjacent Brazil.

M. c. temucoensis W. L. Slater, 1918 - S Chile (from near Concepción) and S Argentina (from R Chubut) S to Tierra del Fuego and Cape Horn. Introduced to Easter I (S Pacific).



Descriptive notes. 38-41.5 cm; male 289 g, female 300 g. All brownish, with dark streaks on sides of head and hindneck; below mottled or barred rufous brown, underwing-coverts cinnamon barred fuscous brown; rather long tail mottled greyish and white, with broad black subterminal band; in flight, conspicuous white uppartail-coverts and pale buff "window", formed by pale grey primaries with black tips; face more extensively feathered than in *M. chimachima*. Iris brown, bare facial skin reddish pink, feet bluish grey. Similar to immatures of *Phalcoboenus*, but considerably smaller. Immature strongly tinged rufous, often with white

spots. Race *temucoensis* darker, smokier brown and more heavily marked.

Habitat. All kinds of open country; found equally in grassy foothills of Andes, heathland, shrub-steppe, marshes, fields, open woods, river valleys and villages; also along coast. Straggles to temperate Andean slopes in C Chile and adjacent Argentina; recorded up to 4000 m. Sometimes forages over burnt land.

Food and Feeding. Feeds on carrion and also live prey, including insects, anurans, eggs and nestling passerines, lizards and worms; turtle eggs taken as they are being laid. Very versatile (see page 230). Hundreds of individuals follow farmers ploughing. Gathers at swarms of large insects, feeding copiously. Can be an important predator on nestlings of (colonial) waterbirds, e.g. Brown-hooded Gulls (*Larus maculipennis*), Southern Lapwings (*Vanellus chilensis*). In C Chile, items in diet: 87%

insects, mostly Coleoptera and Orthoptera; 9% worms (Oligochaetes); and 4% rodents, unidentified birds and lizards. Jumps and runs after prey on ground. Will attack other raptors. In SC Chile, large numbers congregate, along with Kelp Gulls (*Larus dominicanus*), around shellfish processing factories, feeding on remains left attached to discarded shells; also seen taking live clam, and opening it to feed on flesh, breaking shell into pieces in process.

Breeding. In Argentina, laying Sept-Nov (austral spring), with peak in Oct; flying young being fed by adults in Jan, in Tierra del Fuego. Nests colonially: 56 nests in 0.7 ha at one site in Argentina, where nests as little as 10 m apart. Usually nests in trees, but will nest on ground; tree nest c. 35 cm wide, built of sticks often with wool lining. Usually 3 eggs (average 2.77), but up to 5 recorded; incubation 26-27 days, beginning with first egg; fledging 32-34 days.

Movements. S populations appear at least partially migratory, but transition to resident populations not known. Vagrant to Falkland Is.

Status and Conservation. Not globally threatened. CITES II. Currently thriving, and is commonest raptor through much of Chile and Argentina. In SC Chile, fairly common to abundant around many towns, and especially fishing villages; common in Río Grande do Sul, S Brazil. Often closely associated with man, feeding on discarded rubbish.

Bibliography. Belton (1984), Blake (1977), Burger (1974), Contreras *et al.* (1990), Fjeldsá & Krabbe (1990), Fraga & Salvador (1986), Humphrey *et al.* (1970), Jaksic & Jiménez (1986), Johnson (1965), Olog (1962), de la Peña (1992), Pinto (1964), Ruschi (1979), Sick (1985a, 1993), Vuilleumier (1970, 1985), Yáñez *et al.* (1982)

Genus *HERPETOTHERES* Vieillot, 1817

10. Laughing Falcon

Herpetotheres cachinnans

French: Macagua rieur **German:** Lachfalke **Spanish:** Halcón Reidor

Taxonomy. *Falco cachinnans* Linnaeus (ex Rolander MS), 1758, Surinam.

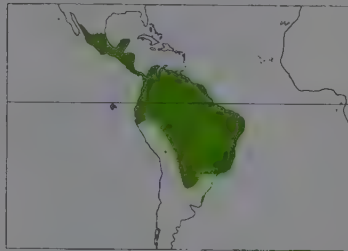
Distinctive genus, most closely allied with *Micrastur*, sometimes awarded its own tribe or even subfamily. Different authors recognize 2-6 races; possible race *excubitor* included within *chapmani*; *maestus* and *fulvescens* within nominate. Three subspecies normally recognized.

Subspecies and Distribution.

H. c. chapmani Bangs & Penard, 1918 - Mexico (S Sonora and San Luis Potosí) S to Honduras.

H. c. cachinnans (Linnaeus, 1758) - Nicaragua to Colombia and S to Peru and C Brazil.

H. c. querubundus Bangs & Penard, 1919 - E Bolivia and E Brazil (S to São Paulo) to Paraguay and N Argentina.



Descriptive notes. 45-53 cm; male 567-686 g, female 626-800 g. Relatively large, aberrant falconid, with short wings and long tail, more typical of proportions of forest-dwelling species of *Micrastur* and *Accipiter*. Large head and underparts cinnamon buff to pale whitish (varying with individual, and with bleaching), with broad black mask from eyes to hindneck; above dark brown to blackish brown; buff underwing-coverts and primary bases contrast with dark barred flight-feathers; rounded tail evenly barred black and whitish and tipped whitish. Stout tarsi and short toes typical of snake-eating raptors. Iris dark brown, cere, legs

and feet dull yellow. Immature has back and wings narrowly edged rufous or buffy brown; whiter below, with thighs sometimes spotted or streaked fuscous brown or buff. Races separated on size and overall intensity of plumage coloration.

Habitat. Tropical and subtropical zones: common at forest edge and open forest in Surinam; mixed palm savanna and forest in Venezuela; rare in stretches of undisturbed forest N of Manaus, NC Brazil, where more common in disturbed, second-growth forest; also along rivers, in clumps of trees and in *cerrado*. Does not occur in interior of primary rain forest; always near clearings, edges, tracks, secondary growth, etc. Nests in all forest types in the Petén (Guatemala), e.g. low swamp forest, closed primary forest near large clearings. Occurs mainly in lowlands, but up to 2400 m in Colombia.

Food and Feeding. Almost exclusively snakes, both terrestrial and arboreal, including large and venomous ones, although most typically harmless ones, e.g. vine snakes (*Philodryas*, *Liophis*). In Petén, of all snakes recorded (c. 20 species): 59% terrestrial; 30% arboreal; and 11% unidentified. In human-altered landscape with some agriculture, rodents, lizards and even fish and a bird have been recorded. In Brazil, reported to take bats leaving a roost at dusk. Typically hunts from open perch, with good visibility; bird sits still for long periods with head slightly bowed.

Breeding. In Costa Rica, eggs in Feb; in Venezuela, Sept (rainy season); in Argentina, Jan; male in breeding condition in May. SW Colombia. In Petén (Guatemala), nests in Feb-Mar (middle of dry season), with hatching probably in Mar-Apr (middle to late dry season), and fledging early in rainy season. Nests 3-33 m above ground using tree cavities, old stick nests, scrapes on epiphytes, or cliffs; tree nests always isolated from surrounding vegetation, either in emergent tree over 5 m above surrounding canopy, or in isolated tree in more disturbed areas or more open forest; little or no building. Pair engages in long (9 min), loud duet near nest, at dawn or dusk; courting pairs often roost near potential nest, vocalizing loudly at dawn and dusk. Usually 1 egg (one record of 2 from Argentina); incubation by female; chick has very soft pale brownish buff down, darker on back, with dark facial mask; fledging c. 57 days; 1 month after fledging, young and parents of one nest seen only 50 m apart, c. 6 km from nest-site. In Petén, of 4 nests found, 2 had ant colonies in the cavity, and only these 2 nests fledged young; in nests without ants, young heavily infected by ectoparasites, dying without having fledged. In continuous forest, has very large home range (up to 2500 ha), which is six times average territory size known for other species of similar size; smaller territories (400-900 ha) seem to be used in more open, disturbed habitats.

Movements. Presumed to be mainly sedentary, but presence said to be temporary all over Brazil.

Status and Conservation. Not globally threatened. CITES II. Uncommon to fairly common within extensive range, e.g. Colombia, Surinam; local throughout most of Brazil. In primary forest seems to maintain lower densities than in disturbed forest.

Bibliography. Blake (1977), Brodkorb (1948), Contreras *et al.* (1990), Davis (1972), Friedmann (1950), Guzmán & Virego (1992), Haverschmidt (1962), Hilty & Brown (1986), Land (1970), Mader (1981), Marchant (1960), Meyer de Schauensee & Phelps (1978), Monroe (1968), Parker (1990, 1991a), de la Peña (1992), Pinto (1964), Ridgely & Gwynne (1989), Ruschi (1979), Russell (1964), Scheffer & Rossem (1944), Sick (1985a, 1993), Skutch (1960, 1971, 1983b), Slud (1964), Snyder (1966), Stiles & Skutch (1989), Thiollay (1980b), Tostain *et al.* (1992), Vaninni (1989), Voous (1969), Wetmore (1944, 1965), Wolfe (1954).



11

grey morph



rufous morph



12



13



14



pale morph



dark morph



tawny morph



16

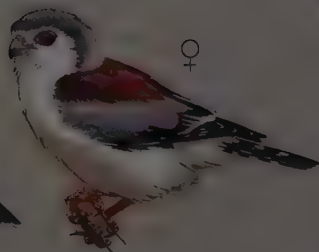


17



♂

18



♀



19

♀

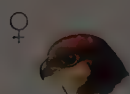


20

rufous-browed individual



21



♀

22



♂



23



dark-fronted individual

24



typical

Genus *MICRASTUR* G. R. Gray, 1841

11. Barred Forest-falcon

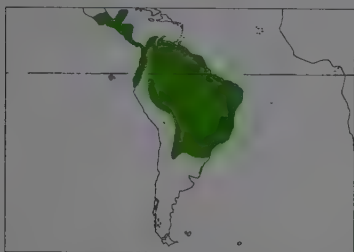
Micrastur ruficollis

French: Carnifex barré German: Sperberwaldfalke Spanish: Halcón-montés Agavilánado

Taxonomy. *Sparvius ruficollis* Vieillot, 1817, South America = Rio de Janeiro. Distinctive genus specialized for life in dense forest: long tail and short wings for manoeuvrability; large ear openings and facial ruff indicate importance of hunting by sound. Most closely related to *Herpethotes*. Until recently considered to include *M. gilvicolis*, but voice and morphology support specific status for *M. gilvicolis*, which is widely sympatric with present species. Possible races *oaxaca* and *kalinowskii* currently included in races *guerilla* and *zonothorax* respectively. Six subspecies normally recognized.

Subspecies and Distribution.

- M. r. guerilla* Cassin, 1848 - S Mexico to Nicaragua.
- M. r. interstes* Bangs, 1907 - Costa Rica and Panama to W Colombia and W Ecuador.
- M. r. zonothorax* (Cabanis, 1865) - Colombia and Venezuela, in E Andean foothills, S perhaps to Bolivia.
- M. r. concentricus* (Lesson, 1830) - S Venezuela, the Guianas and Amazonia.
- M. r. ruficollis* (Vieillot, 1817) - S of Amazonia in Brazil, Paraguay and NC & NE Argentina.
- M. r. olrogi* Amadon, 1964 - NW Argentina, in subtropical forests.



Descriptive notes. 33-38 cm; male 161-167 g, female 196-232 g. Plumage highly variable within and between races; rufous and grey morphs present in some races. Blackish grey to rufous brown above; throat white to rufous; white below, with variable amounts of fairly heavy black or grey barring; tail almost black, with three (occasionally two or four) narrow white bars; facial skin yellow-orange, iris brown. Very similar to *M. gilvicolis*, from which distinguished by iris colour, longer tail and generally stronger barring on underparts. Female larger, tinged brownish in some races; sometimes more heavily barred than male. Im-

mature tends to be more brownish than adults, varying from white to cinnamon buff below, with more or less barring; some white spotting on uppertail-coverts in Amazonian race *concentricus*. Races separated primarily on size, amount of barring and grey or rufous background colour to underparts.

Habitat. Humid and wet tropical forests; in Central America, high, mature forests; in Amazonia and S Brazil, most often in second-growth forest, including forest edge habitat, tidal swamp forest, and gallery forest. In Amazonia, customary use of secondary habitat contrasts with tendency of sympatric *M. gilvicolis* to occur more commonly in primary forest; also differs from latter in tolerance of forests with more pronounced dry season, even semi-deciduous forests; much less abundant in areas where co-exists with *M. gilvicolis*. Commonly ranges up to 2500 m, with single record at 3000 m in Colombia.

Food and Feeding. Most frequently lizards; also birds, including motmots, toucanets, robins and flycatchers; arthropods, bats, snakes, frogs and one crab. Of 587 prey items identified in the Petén (Guatemala); most were lizards (41%); only 14% birds; but 33% unidentified. By biomass, birds and lizards equally important (33%) in diet during breeding season. In general, morphologically convergent with forest-dwelling members of *Accipiter* in having short wings and long tail, but does not share long, narrow toes of specialist bird-eaters. Present species follows army ant (*Eciton burchelli*) swarms more frequently than congeners. Present species follows small birds following ant swarm immediately upon arrival, but spends most of time perched over swarm, dropping down to ground and often running after small prey items flushed by ants. Once seen "passively anting", fluffing feathers and squatting into ant swarm, as if brooding, for a minute before flying off.

Breeding. Virtually all data from Petén (Guatemala). Laying in May (late dry season); in Manaus (NC Brazil), recently fledged young in early Jun. Courtship entails calling, which begins c. 30-40 minutes before sunrise, and courtship feeding. Female stays by nest, defending it from potential competitors (toucans and parrots). Nests in tree cavities, which may be reused at least 3 years running; unlike case of *M. semitorquatus*, nest-site has very few vines around, but very dense canopy cover, generally higher than in areas used by *M. semitorquatus*; prefers breaks in canopy around nest tree, perhaps to reduce predation by snakes. Nest cavity c. 12-23 m high, with entrance usually c. 15 cm wide; nests with larger entrances lost clutches to predation. Averages 2-8 eggs, second clutch can be laid after nest failure; incubation 35 days; fledging c. 38 days (35-44), fledglings with tails only half-grown. Within 2 weeks of fledging, young begin to catch arthropods on ground, and scratch in leaf litter for insects; by week 3, follow army ant swarms, catching *Anolis* lizards; by week 5, young range 500 m from nest, and begin to chase birds; by week 6, prey delivery by male greatly reduced. Male delivers all of food during incubation, and most (over 66%) of food throughout nesting period. Hatching success 45% of hatched eggs, 84% fledged; net productivity of 1-1 young per nesting attempt. During breeding, home range of female averaged 67 ha, of male 114 ha, with some overlap of territories. One immature female maintained a fledgling, apparently after successful breeding. High mate and nest-site fidelity, low annual mortality or turnover.

Movements.

Conservation. Sedentary. Not globally threatened. CITES II. Along with *M. gilvicolis*, probably one of most abundant raptors in Amazonian forests. Average estimated density of at least c. 10 individuals/10,000 ha of forest in French Guiana; in Petén (Guatemala) c. 1 pair/100 ha. Locally fairly common in Colombia, especially in foothills and on lower slopes; reported to be uncommon in Panama, although possibly due to fact that species is very unobtrusive. Virtually all data available on breeding biology is result of Peregrine Fund's remarkable Maya Project, involving studies of 38 nesting attempts in the Petén of Guatemala.

Bibliography. Amadon (1964), Bierreguard (1988), Blake (1977), Contreras *et al.* (1990), Darrieu & Martinez (1984), Enquist *et al.* (1992), Friedmann (1950), Hilty & Brown (1986), Monroe (1968), Oniki & Willis (1982), de la Peña (1992), Pinto (1964), Ridgely & Gwynne (1989), Ridgway (1875), Schwartz (1972), Sick (1985a, 1993), Slud (1964), Smith (1969), Stiles & Skutch (1989), Terborgh & Weske (1975), Thiollay (1989a), Thorstrom (1989, 1990a, 1993), Thorstrom & Morales (1993), Thorstrom, Morales & Maleo (1992), Thorstrom, Quixachán & Morales (1991), Thorstrom, Turley *et al.* (1990), Wetmore (1965), Willis & Oniki (1978), Willis *et al.* (1983).

12. Plumbeous Forest-falcon

Micrastur plumbeus

French: Camifex plombé German: Einbinden-Waldfalke Spanish: Halcón-montés Plomizo
Other common names: Sclater's Forest-falcon

Taxonomy. *Micrastur plumbeus* W. L. Sclater, 1918, Río Bogotá, Esmeraldas, Ecuador.

Has been included within *M. gilvicolis*; sympatric with *M. ruficollis interstes*, so when *gilvicolis* was included within *M. ruficollis*, *plumbeus* was elevated to species rank; now that *M. ruficollis* and *gilvicolis* have been shown to be separate species, status of *plumbeus* unclear, but generally retained as full species; further research required to clarify taxonomic status. Monotypic.

Distribution. SW Colombia (Cauca, Nariño) and NW Ecuador (Esmeraldas).



Descriptive notes. 30-37 cm. Above slate grey, with head, neck and centre of back paler; throat and breast grey, fading to whitish with fine blackish barring on lower breast, flanks and belly; black tail tipped white, with single narrow white bar through middle. Cere and feet yellow, iris yellowish to reddish brown. Tail pattern separates from congeners. Immature white below, with faint barring on flanks and breast.

Habitat. Interior of wet forest in lowlands and foothills of Pacific slope at 20-1000 m; may reach subtropical zone.

Food and Feeding. Virtually nothing known.

Stomach contents of 1 bird were a land crab and a lizard.

Breeding. No information available. Probably nests in tree cavities, as do congeners of which nests have been found.

Movements. Presumably sedentary.

Status and Conservation. VULNERABLE. CITES II. Suffering from deforestation and degradation of habitat within limited range, both in Colombia and Ecuador; surveys and protection required. Recorded within Munchique National Park, Colombia; also very near Cotacachi-Cayapas Ecological Reserve, Ecuador, which undoubtedly holds the species, but this large reserve is now being opened up for logging. Apparent rarity may be due also to secretive nature of *Micrastur*, and confusion with similar sympatric *M. ruficollis*.

Bibliography. Amadon (1964), Blake (1977), Brown & Amadon (1968), Collar & Andrew (1988), Collar *et al.* (1992), Hilty & Brown (1986), Meyburg (1986).

13. Lined Forest-falcon

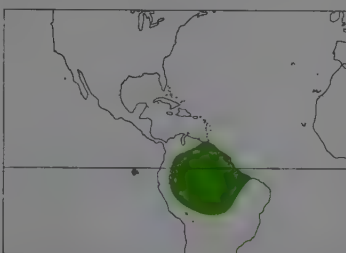
Micrastur gilvicolis

French: Camifex à gorge cendrée Spanish: Halcón-montés Cabecigrís
German: Zweibinden-Waldfalke

Taxonomy. *Sparvius gilvicolis* Vieillot, 1817, no locality = Cayenne.

Recently split as valid species from *M. ruficollis*. Often considered to include *M. plumbeus* as race. Monotypic.

Distribution. E Colombia through S Venezuela to the Guianas, and S throughout Amazonia.



Descriptive notes. 33-38 cm; 172-223 g (average 211 g). Back pale grey; white below, with barring very variable in extent, from heavy all over, to much lighter and restricted to breast; dark tail has white tip and 2 (occasionally 1) narrow white bars. Iris white, facial skin typically reddish orange, legs yellow. Differs from *M. ruficollis* in colour of iris; tail usually has fewer bars; tail shorter, wings longer than in *M. ruficollis*, giving very different wing/tail ratios for the two species. Differs from *M. plumbeus* in tail pattern. Immature slightly browner; iris brown.

Habitat. Primary tropical forests in lowlands; in Colombia, occurs in humid *terra firme* forest. May range up to 1600 m.

Food and Feeding. Not well documented. Lizards and large insects; some birds; in French Guiana, mostly snakes. Hunts primarily in forest understorey. Follows army ant swarms, although less frequently and for shorter periods than *M. ruficollis*. Takes some birds (causes considerable mortality amongst birds trapped in mist-nets), but does not have foot structure of specialist on avian prey; passerines foraging near it, over army ant swarms, do not seem particularly afraid of it, in contrast to their behaviour when a small *Accipiter* approaches.

Breeding. Only nest record is of a stick nest, but this would be uncharacteristic of *Micrastur*; probably based on misidentification, as all other records for the genus involve cavity nests. Tail of a female trapped near Manaus, NC Brazil, was dirty, bent and broken off (all feathers roughly same length), as would be expected if the bird had been incubating in a small tree cavity. Breeding biology probably similar to closely related *M. ruficollis*.

Movements.

Conservation. Sedentary. Not globally threatened. CITES II. Probably the most abundant diurnal raptor over much of lowland forest of Amazonia, where it attains very high densities; territories

On following pages: 14. Slaty-backed Forest-falcon (*Micrastur mirandollei*); 15. Collared Forest-falcon (*Micrastur semitorquatus*); 16. Buckley's Forest-falcon (*Micrastur buckleyi*); 17. Spot-winged Falconet (*Spizapteryx circumcinctus*); 18. African Pygmy-falcon (*Polihierax semitorquatus*); 19. White-rumped Pygmy-falcon (*Polihierax insignis*); 20. Collared Falconet (*Microhierax caeruleus*); 21. Black-thighed Falconet (*Microhierax fringillarius*); 22. White-fronted Falconet (*Microhierax latifrons*); 23. Philippine Falconet (*Microhierax erythrogenys*); 24. Pied Falconet (*Microhierax melanoleucus*).

in central Amazon are c. 100 ha, with fairly even distribution throughout the forest. Average estimated density of at least c. 70 individuals/10,000 ha of forest in French Guiana, where the only raptor species apparently more abundant was *Daptrius americanus*.

Bibliography. Amadon (1964), Bierregaard (1988), Blake (1977), Hilty & Brown (1986), Klein & Bierregaard (1988a, 1988b), Koepcke (1972), Meyer de Schauensee & Phelps (1978), Pinto (1964), Schwartz (1972), Sick (1985a, 1993), Snyder (1966), Thiollay (1989a), Willis *et al.* (1983).

14. Slaty-backed Forest-falcon

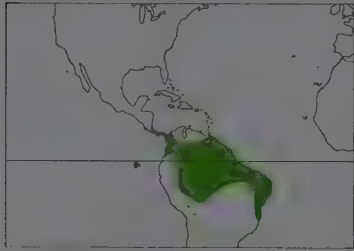
Micrastur mirandollei

French: Carnifex ardoisé **German:** Graurücken-Waldfalke **Spanish:** Halcón-montés Dorsigrís

Taxonomy. *Astur mirandollei* Schlegel, 1862, Surinam.

Birds from NW of range have occasionally been placed in separate race, *extimus*, but not normally recognized. Monotypic.

Distribution. Costa Rica, Panama and Colombia (including W slope of Andes) through the Guianas and Amazonia to E Brazil (Espírito Santo).



Descriptive notes. 40-45 cm; c. 556 g. Slate grey above, darker on crown and tail; tail shorter than in other *Micrastur* species, with three often indistinct pale bands and narrow white tip; underparts, including wing linings, white or tinged buff. Very similar to immature *Accipiter bicolor* and some immatures of *M. ruficollis*, and also to *Leucopternis semiplumbea* and *Accipiter poligaster*; differs in structure, notably in longer legs and more extensive bare facial skin, and in fine details of plumage. Iris yellowish brown, cere yellow, legs and feet bright yellow. Immature brownish above; off-white to yellowish buff below,

with feathers edged fuscous brown, giving scaly effect.

Habitat. Lowland tropical rain forest, often in fairly undisturbed parts but also in tall secondary growth. In areas of overlap with *M. semitorquatus*, present species occupies canopy or upper levels of forest.

Food and Feeding. Very little information available. Feeds on birds. Hunts in middle to lower levels of forest. Reportedly perches low in understorey, uttering calls that elicit mobbing response from small birds; once flock of birds is attracted, forest-falcon moves stealthily, sometimes on foot, to another perch, where it resumes calling; birds caught as they move about trying to relocate the calling forest-falcon; these unusual observations require corroboration.

Breeding. No information available. Presumably nests in tree cavities, as do congeners.

Movements. Presumably sedentary.

Status and Conservation. Not globally threatened. CITES II. Status very poorly known, perhaps in part because so easily confused with other species. Widely distributed, but everywhere rare. One of rarest forest raptors in French Guiana, with estimated minimum average density of only 4 individuals/10,000 ha of forest.

Bibliography. Amadon (1964), Blake (1977), Brown & Amadon (1968), Hilty & Brown (1986), Meyer de Schauensee & Phelps (1978), Pinto (1964), Remsen & T aylor (1989), Ridgely & Gwynne (1989), Sick (1985a, 1993), Slud (1964), Smith (1969), Snyder (1966), Siles & Skutch (1989), Thiollay (1989a), Tostain *et al.* (1992), Wetmore (1965).

15. Collared Forest-falcon

Micrastur semitorquatus

French: Carnifex à collier **German:** Kappenwaldfalke **Spanish:** Halcón-montés Collarejo

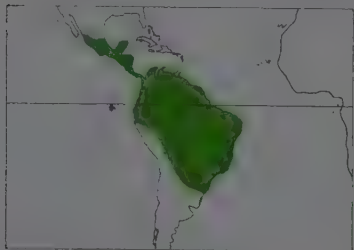
Taxonomy. *Sparvius semi-torquatus* Vieillot, 1817, Paraguay.

Sometimes, especially in past, considered to include *M. buckleyi*. Two subspecies normally recognized.

Subspecies and Distribution.

M. s. naso (Lesson, 1842) - NC Mexico (Sinaloa to Tamaulipas) S through Central America to N & W Colombia and Ecuador.

M. s. semitorquatus (Vieillot, 1817) - E Colombia E to the Guianas, and S through E Peru, N & E Bolivia and Brazil to Paraguay and N Argentina.



yellow. Considerably larger than *M. buckleyi*, usually with more tail bands. Female similar to male, but larger. Immature varies from pale morph to a darker one, but all intermediate plumages have been found, suggesting progression of moults leading to adult plumage, reached only in third year; above dark brown, with contour feathers edged pale brown (edging gradually phased out with age); brownish nuchal collar inconspicuous or lacking; crown blackish; tail blackish, with barring white or brownish; underparts white to cinnamon buff, conspicuously barred brownish black; breast can be washed with chestnut; dark morph is all dark brown with rufous or white barring on thighs, belly and secondaries. Race *naso* generally very similar, but slightly larger and a little darker in all plumages.

Habitat. Lowland tropical rain forest, typically seen at forest edge; second-growth forest, especially with dense understorey, also occurs in mangroves. Widely distributed in semi-deciduous and semi-evergreen forests throughout Yucatán. Recorded up to 1950 m in Panama. In areas of overlap with *M. mirandollei*, present species occupies understorey.

Food and Feeding. Mammals and birds, including large species, e.g. chachalacas, toucans, cocks-of-the-rock, Great Curassow (*Crax rubra*), Ocellated Turkey (*Meleagris ocellata*), Crested

Guan (*Penelope purpurascens*) and Mottled Owl (*Ciccaba virgata*). Of 223 prey items recorded in Petén (Guatemala) during breeding season: 46% of identified items were mammals, mostly medium-sized, e.g. squirrels, rats, bats; 35% birds; and 20% lizards and snakes; 1 frog. Appears to locate prey by hearing, and will often run prey down on the ground. Infrequently follows army ant swarms, when takes prey flushed by ants. Like *M. mirandollei*, reportedly attacks birds attracted to rapid, whining call made from a low branch, only 1-2 m above ground; this needs corroboration.

Breeding. Virtually all data from Petén (Guatemala). Laying in Mar-Apr (late dry season) in Petén. Calls both before dawn and after sunset; courtship feeding. Female remains near potential site, to defend against potential usurpers; unlike *M. ruficollis*, no evidence for territoriality. Nests in cavities, usually with multiple entrances, 12-20 m above ground; nests in very large, mature trees in areas with many large and small vines, a less densely closed canopy and generally lower canopy level than in case of *M. ruficollis*. 2-3 eggs (average 2.1); incubation 46 days; fledging 46-50 days. In latter part of nestling phase, male begins to deliver food to nest, if female away hunting. Male fed young for 1 month after fledging, at which point another adult male "adopted" the young, providing 36 prey items (almost all toucans) during period 4-14 weeks after fledging; the apparent natural parents disappeared after week 4. Young range up to 3 km from nest during first 3 months after fledging; begin to pursue potential prey 6 weeks after fledging. Fidelity to mate and nest-site high: one site used 5 years running; young fledged successfully from one nest 3 years in a row, so no prolonged post-fledging dependency.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES II. Not uncommon over vast range; secretive nature presumably reduces threat from hunters. In French Guiana, average estimated density of at least c. 12 individuals/10,000 ha. Non-breeders in Petén had home ranges of 2.3-8.8 km², breeding pairs of c. 11 km². First nest for genus only discovered in 1978; since then, virtually all data available on breeding biology of species is result of Peregrine Fund's Maya Project, involving studies of 8 nests in Tikal National Park, Petén (Guatemala).

Bibliography. Blake (1977), Contreras *et al.* (1990), Enquist *et al.* (1992), Friedmann (1950), Hilty & Brown (1986), Lowery & Dalquest (1951), Mader (1979b), Mays (1985), Monroe (1968), Peeters (1963), de la Peña (1992), Pinto (1964), Ridgely & Gwynne (1989), Rivera & Córdova (1992), Russell (1964), Sick (1985a, 1993), Slud (1964), Smith (1969), Smithe & Paynter (1963), Siles & Skutch (1989), Thiollay (1989a), Thorstrom (1989, 1990b, 1993), Thorstrom *et al.* (1990, 1991b), Trail (1987), Vannini (1989), Wetmore (1965, 1974), Willis *et al.* (1983).

16. Buckley's Forest-falcon

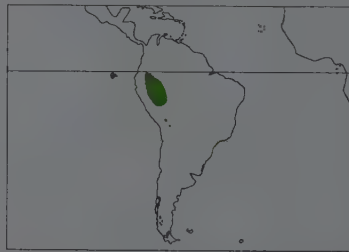
Micrastur buckleyi

French: Carnifex de Buckley **German:** Traylorwaldfalke **Spanish:** Halcón-montés de Buckley
Other common names: Lesser Collared/Traylor's Forest-falcon

Taxonomy. *Micrastur melanoleucus buckleyi* Swann, 1919, Sarayacu, Ecuador.

Known only from about a dozen specimens and a few sightings; formerly considered a variant of *M. semitorquatus*. Monotypic.

Distribution. Amazonian reaches of Ecuador and Peru; single record from SE Colombia; apparent recent record from Brazil (R Jurua, Acre) has now been withdrawn.



Descriptive notes. 41-51 cm. Above black, with some white feather edging on wing-coverts; black of cap extends down behind the eye; prominent white collar; immaculate white below; tail black with narrow white bands, three on central, four on outer rectrices. Smaller version of *M. semitorquatus*, to which nearly identical in plumage; invariably only four white bands in outer tail feathers; proportionately shorter tarsi. Female similar to male, but has white spots on scapulars and secondaries. Immature (1 subadult) black above, as adult, with buffy breast and broadly spaced dark barring on belly.

Habitat. Said to occur in lowland forest, but recorded at 1800 m in Cordillera Cutucú, Ecuador; one record in middle storey of inundated primary forest, possibly referring only to single bird.

Food and Feeding. No information available. One report (from museum label) of a small tree-rat (*Mesomys*). Small feet suggest species is not specialist on avian prey; short tarsi suggest it may feed in trees.

Breeding. No information available. One record of a recently fledged young (c. 1 week after fledging) in Jul in Boca Manu, Peru. Probably nests in tree cavities, as is typical of genus.

Movements. Presumably sedentary.

Status and Conservation. INSUFFICIENTLY KNOWN. CITES II. Status virtually unknown. Secretive nature of genus and sympatry with very similar *M. semitorquatus* render estimates of population levels very difficult. Surveys required to establish limits of range and densities. Evidence suggest that species is not immediately threatened; however, at least in part of range, habitat is in process of being cleared.

Bibliography. Amadon (1964), Blake (1977), Collar & Andrew (1988), Collar *et al.* (1992), Hilty & Brown (1986), Meyburg (1986), Meyer de Schauensee (1982), O'Neill & Pearson (1974), T aylor (1948, 1958).

Subfamily FALCONINAE

Genus SPIZIAPTERYX Kaup, 1852

17. Spot-winged Falconet

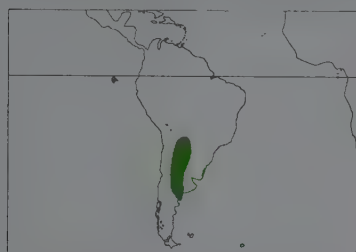
Spizapteryx circumcinctus

French: Carnifex à ailes tachetées **German:** Tropfenfalke **Spanish:** Halcóncito Argentino

Taxonomy. *Haipagus circumcinctus* Kaup, 1852, Chili: error. Mendoza, Argentina. Taxonomic position unclear, and species frequently placed in present subfamily or in Polyborinae; variously associated with Old World genus *Polihiarax*, or with aberrant Neotropical falconids

Micrastur, *Herpetotheres* and caracaras; sometimes considered closest to caracaras, but alternatively placed apart in separate subfamily alongside only *Herpetotheres*. Monotypic.

Distribution. E Bolivia (Santa Cruz) through Paraguay to N & C Argentina (S to Río Negro).



Descriptive notes. 28.5-33 cm; c. 150 g. Diminutive. Back, head and wings greyish brown; pale streak above and behind eye, black ear-coverts and narrow black moustachial streak; shoulders spotted white, rump white; throat and lower belly white; breast, sides and upper belly greyish, narrowly streaked brown; central rectrices dark, rest of tail barred white, with white tip; conspicuous white spots on wing, white underwing-coverts. Iris pale yellow, cere, feet and legs yellow. Female similar, but slightly larger. Unlike other falconids, no distinct immature plumage.

Habitat. Savanna, woodland with scrub and semi-desert. Chaco in Bolivia; semi-open Chaco forest in Argentina.

Food and Feeding. Feeds on insects (Orthoptera, cicadas), lizards and birds. Bird prey includes adult and young Monk Parakeets (*Myiopsitta monachus*); present species roosts in communal nests of these parakeets in winter, and nests in them in summer; actually observed roosting in active Monk Parakeet nests, with parakeets entering chamber after the falconets, and spending the night with them.

Breeding. Very little information available. Laying in Nov-Dec, in Argentina. Nest in woven, closed nests of other species, e.g. cachaletes (Furnariidae) and sometimes active Monk Parakeet colonies; near Córdoba (NC Argentina), 15 out of 70 Monk Parakeet nests also had a nesting pair of falconets. For nesting, Monk Parakeet nest entrances are enlarged to 20 cm high x 30 cm wide, and nest chamber enlarged into roughly spherical cavity c. 30 cm wide. 2-4 eggs; fledging probably c. 33 days.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES II. Status virtually unknown; habitat is not amongst most seriously devastated in the region. Single record from Paraguay.

Bibliography. Blake (1977), Cabot *et al.* (1988), Contreras *et al.* (1990), Dean (1971), Griffiths (1994), Kratter *et al.* (1993), Martella & Bucher (1984), Mariella *et al.* (1985), Meyburg (1986), Narosky *et al.* (1992), Olson (1976), Pereyra (1937), de la Peña (1992), Remsen & Traylor (1989), Straneck & Vasina (1982).

Genus *POLIHIERAX* Kaup, 1847

18. African Pygmy-falcon

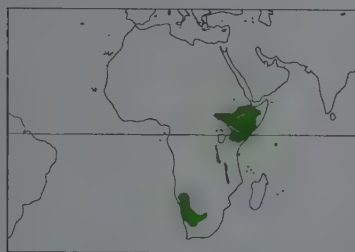
Polihierax semitorquatus

French: Fauconnet d'Afrique **German:** Halsband-Zwergfalke **Spanish:** Halconcito Africano
Other common names: Pygmy Falcon

Taxonomy. *Falco semitorquatus* [sic] A. Smith, 1836, Kuruman, Botswana.

N population sometimes separated as race *castanonotus*, but poorly differentiated, although widely separated geographically. Monotypic.

Distribution. S Ethiopia, Somalia, NE Uganda and Kenya to NC Tanzania; S Angola and Namibia to NW South Africa.



Descriptive notes. 20 cm; 54-67 g; wingspan 37 cm. Tiny shrike-sized falconet with white-spotted wings and tail. Female with chestnut back when juvenile and adult. Juvenile has buff breast. No consistent colour or size differences between separate populations.

Habitat. Arid and semi-arid steppe with sparse ground cover and scattered large trees or tree-like *Aloe* plants. Relies on weaver nests for roost- and nest-sites, especially those of Sociable Weaver (*Philetairus socius*) in S Africa, and of White-headed Buffalo-weaver (*Dinemellia dinemelli*) in NE Africa. Pairs or families often roost together in the same

weaver nest-chamber, or an adjacent one. Sometimes roosts in nests of sparrow-weavers (*Plocpasser*) and some starling species.

Food and feeding. Mainly small lizards and large insects, but also some rodents, birds and other arthropods. Pounces on prey from a perch and takes most items on the ground, rarely after a short aerial chase. Occasionally catches the host weavers or takes their chicks.

Breeding. Sometimes polyandrous. Laying Jun-Dec in NE Africa; Aug-Mar in S Africa; double-brooded in some years. Calling, head-bobbing and bowing displays, with tail-pumping, increase prior to nesting. Pair occupies a weaver nest-chamber, the nest lip becoming obviously coated with white droppings that turn pink with age. Usually 3 eggs (2-4); incubation 28-30 days; chicks have white down; fledging 27-40 days; juveniles remain in parental territory for up to 2 months after fledging.

Movements. Resident in most areas but some local movement in drier parts of range, leaving areas during periods of extreme aridity. Also vagrant to moister habitats in Kenya, S Tanzania and probably NE South Africa and S Mozambique. Confined to nest chamber for up to 15 hours a day during winter, with moderate hypothermia.

Status and Conservation. Not globally threatened. CITES II. Widespread and common in most areas, range of its weaver host in S Africa being extended by availability of nest-sites on utility poles and other man-made structures. Land use within its range does not require pesticides, and species may even benefit where grazing by livestock reduces ground cover. Occurs within some large game reserves and national parks. Favours larger weaver nest masses, occupying about 12-25% of nest masses available; uses up to six chambers for each of its nests; pairs spaced 1.84-2.1 km apart in the Namib and Kalahari Deserts.

Bibliography. Ash & Miskell (1983), Brown, C.J. (1989b), Brown, L.H. *et al.* (1982), Dancel (1966b), Ginn *et al.* (1989), Griffiths (1994), Lewis & Pomeroy (1989), Mackworth-Praed & Grant (1957, 1962), Maclean (1970, 1993), Marx & Adam (1986), Pickford *et al.* (1989), Sapsford (1986), Snow (1978), Steyn (1982), de Swardt (1990b), Thomsett (1991b).

19. White-rumped Pygmy-falcon

Polihierax insignis

French: Fauconnet à pattes jaunes

German: Langschwanz-Zwergfalke

Spanish: Halconcito Asiótico

Other common names: Fielden's Falconet, White-rumped Falcon

Taxonomy. *Polihierax insignis* Walden, 1872, Tongoo, Upper Burma.

Sometimes awarded separate, monotypic genus, *Neohierax* (see page 219). Racial variation slight; validity of subspecies requires reassessment. Three subspecies currently recognized.

Subspecies and Distribution.

P. i. insignis Walden, 1872 - W & C Burma, especially in valley of R Irrawaddy.

P. i. cinereiceps Stuart Baker, 1927 - S Burma (Tenasserim) and Thailand.

P. i. harmandi Oustalet, 1876 - S Indochina, in S & C Laos, S Vietnam (S Annam, Cochinchina) and Kampuchea.



Descriptive notes. 23-28 cm; 84-112 g; wingspan 43-49 cm. Large grey and white falconet with conspicuous white uppertail-coverts; larger than *Microhierax* falconets. Head, nape and upper back grey in male, rufous in female. Juvenile similar to adult male, but with white collar and brown streaking on underparts. Races differ very slightly, if at all, in plumage: *cinereiceps* said to be somewhat darker above; *harmandi* apparently has head paler in male.

Habitat. Open woodland, often around clearings; also in savanna. Occurs from lowlands up to 700 m.

Food and Feeding. Large insects and small birds; also frogs, snakes, lizards and small mammals. Hunts from exposed perches, making sallies to take flying insects and birds, and also dropping to ground to capture grasshoppers, lizards and small mammals. Flight rather weak and fluttery.

Breeding. Little studied. Season Feb-Apr; pair breeding in Feb; female with egg in Mar. Reported to use stick nest previously occupied by other raptors or by corvids. No further information available.

Movements. Apparently sedentary.

Status and Conservation. Not globally threatened. CITES II. Uncommon and local in Thailand. Little known, but appears to be relatively secure at present; reasonably broad habitat tolerance suggests species may be adaptable to human pressure that is rather intense throughout most of range.

Bibliography. Brown & Amadon (1968), Deignan (1945), Griffiths (1994), King *et al.* (1975), Lekagul & Round (1991), Riley (1938), Smythies (1986).

Genus *MICROHIERAX* Sharpe, 1874

20. Collared Falconet

Microhierax caerulescens

French: Fauconnet à collier

German: Rotkehlfalkchen

Spanish: Falconete Acolorado

Other common names: Red-thighed/Red-legged/Red-breasted Falconet

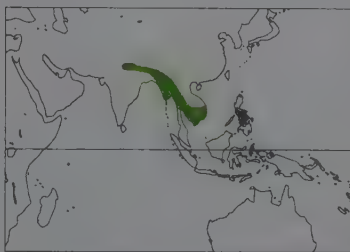
Taxonomy. *Falco caerulescens* Linnaeus, 1758, Asia = Bengal.

Genus apparently closest to Afrotropical *Polihierax semitorquatus*. Races differ little, with *burmanicus* doubtfully valid. Two subspecies normally recognized.

Subspecies and Distribution.

M. c. caerulescens (Linnaeus, 1758) - E Himalayas of India (Kumaon) and Nepal to NE India (N Assam).

M. c. burmanicus Swann, 1920 - Burma E to C & S Indochina.



Descriptive notes. 15-18 cm; 30-50 g; wingspan 30-34 cm. A falconet very shrike-like in size and behaviour. Thick black eyestripe, rufous belly and legs, and white collar distinctive. Female very similar to male, but slightly larger; tends to have more white in wing, with nuchal collar less conspicuous. Some individual variation may exist: birds with rufous brow and white throat sometimes said to be adult females, but most, perhaps all, are probably immatures. Dubious race *burmanicus* smaller; nuchal collar said to be wider, breast whiter.

Habitat. Open forest and forest edge, often near rivers or streams, from sea-level up to

900 m.

Food and Feeding. Feeds mainly on large insects, especially butterflies; also birds, some rather large, and lizards. Hunts from exposed perch in dead tree or large open tree above forest canopy, at forest edge, or along stream or river; occasionally hunts in small groups of up to 7 individuals. Prey usually taken in the air, but also from leaves and small branches; captured after swift, powerful, shrike-like attack flight; taken back to perch for consumption. Tends to be most active around dusk, sometimes catching moths. Perched bird frequently bobs tail.

Breeding. Season usually Feb-May. Nests in old nest-holes of barbets, occasionally in holes in buildings. Display flights not recorded; courtship includes allopreening. Normally 4-5 eggs, but sometimes as few as 2. Parents aggressive in nest defence. Nest-hole may be occupied all year round. No further information available.

Movements. Sedentary. Vagrant to Yunnan (SC China).

Status and Conservation. Not globally threatened. CITES II. Fairly common to uncommon throughout much of extensive range. Tolerance of disturbed habitats, along with fairly varied diet, suggests species in no danger.

Bibliography. Ali & Ripley (1978), Brown & Amadon (1968), Cheng Tso-hin (1987), Deignan (1945), Inskipp & Inskipp (1985), King *et al.* (1975), Lekagul & Round (1991), Ripley (1982), Smythies (1986).

21. Black-thighed Falconet

Microhierax fringillarius

French: Fauconnet moineau **German:** Finkenfalkchen **Spanish:** Falconete Indonésio
Other common names: Black-legged/Black-tailed/Black-sided/Malay Falconet

Taxonomy. *Falco fringillarius* Drapiez, 1824. "Indes" = Sumatra.

Sometimes regarded as race of *M. caerulescens*, but plumage distinct, with no intergradation recorded. Monotypic.

Distribution. S Burma (S Tenasserim) and S Thailand through Peninsular Malaysia to Sumatra, Borneo, Java and Bali.



Descriptive notes. 14-17 cm; 28-55 g; wing-span 30-34 cm. Small falconet, similar to *M. caerulescens* but more rufous on underparts; black flanks and thighs; lacks white collar. Female similar to male but larger. Juvenile has rufous wash on white parts of head.

Habitat. Open forest, forest edge and clearings from sea-level up to 1300 m. In Sumatra, sometimes attracted to patches of active slash-and-burn forest destruction, where prey presumably more abundant and more readily available; also hunts over nearby cultivation.

Food and Feeding. Preys mainly on large insects, including butterflies, moths, cicadas and

termites; also birds, some rather large, and lizards. In Malaysia, prey ranged in size from small insects 0.5 cm in length to large moth with wingspan of c. 20 cm. Hunts from exposed perch in dead tree or large open tree above forest canopy, at forest edge, or along stream or river; sometimes hunts in groups of up to 10 individuals. Feeds communally, with up to 4 falconets eating from single prey item; communal hunting and feeding may be important for young to learn which insects are suitable prey. Prey usually taken in the air, but also from leaves and small branches; captured after swift, powerful attack flight. Perched bird frequently bobs tail. In Malaysia, most strikes made level with perch or below it; 46% success rate recorded in 57 attempted strikes. **Breeding.** Laying Nov-Dec in Borneo; normally Feb-Mar in Peninsular Malaysia, Sumatra and Java; three fledglings in Aug, in Malaysia; evidence of active breeding in Feb, Apr, Jun and Sept in Padang-Sugihan Reserve (S Sumatra). Nests c. 6-20 m up, in old nest-holes of barbets, occasionally in holes in buildings. Display flights not recorded; courtship includes allopreening, with bouts often lasting 30 minutes; one record of pair copulating, while another individual perched less than 1 m away. Normally 4-5 eggs, but sometimes as few as 2. Nest-hole occupied all year round. No further information available.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES II. Fairly common to common, e.g. in reserve of Padang-Sugihan (S Sumatra) in mid-1980's. Tolerance of disturbed habitats, along with fairly varied diet, suggests species in no danger.

Bibliography. Brown & Amadon (1968), Holmes & Burton (1987), Kemp & Crowe (1994b), King *et al.* (1975), Lekagul & Round (1991), MacKinnon (1988), MacKinnon & Phillips (1993), Madoc (1976), van Marle & Voous (1988), Medway & Wells (1976), Meyer de Schauensee & Ripley (1940), Molesworth (1955), Riley (1938), Smythies (1981, 1986), Thiollay & Meyburg (1988), Wilkinson *et al.* (1991a, 1991b).

22. White-fronted Falconet

Microhierax latifrons

French: Fauconnet de Bornéo **German:** Weißscheitelfalkchen **Spanish:** Falconete de Borneo
Other common names: Bornean Falconet

Taxonomy. *Microhierax latifrons* Sharpe, 1879, Lawas River and Lumbidan, Borneo. Monotypic.

Distribution. N Borneo, in extreme NE Sarawak and Sabah.



Descriptive notes. 15-17 cm; 35-65 g. Typical falconet, distinguished from sympatric *M. fringillarius*, and indeed from all congeners, by having forehead and forecrown white in male, chestnut in female; pale tan wash on belly. Juvenile almost identical to adult female.

Habitat. Open forests and clearings from sea-level to above 1200 m.

Food and Feeding. Mainly insects, including bees, but also reported pursuing birds. Family parties observed; probably hunting gatherings similar to those reported for *M. fringillarius*. Presumably hunts in similar fashion to latter

species.

Breeding. Thought to breed in Mar-Apr; account of family group in Nov probably refers to hunting group, rather than evidence of recent breeding. Reported to nest in old woodpecker and barbet holes. No further information available.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Status uncertain, but species appears to be fairly common within its restricted range. Long

term threat could be loss of forest habitat. Research required especially on breeding biology; surveys also recommended, in order to clarify status.

Bibliography. Brown & Amadon (1968), MacKinnon & Phillips (1993), Meyburg (1986), Smythies (1981).

23. Philippine Falconet

Microhierax erythrogenys

French: Fauconnet des Philippines **German:** Zweifarbenfalkchen **Spanish:** Falconete Filipino

Taxonomy. *Hierax erythrogenys* Vigors, 1831, near Manila.

Often erroneously spelt *erythronys*. Two subspecies recognized.

Subspecies and Distribution.

M. e. erythrogenys (Vigors, 1831) - Luzon, Mindoro, Negros and Bohol (Philippines).

M. e. meridionalis Ogilvie-Grant, 1897 - Samar, Leyte and Cebu to Mindanao (Philippines).

Descriptive notes. 15-18 cm; 37-52 g. Typical falconet, lacking any rufous in plumage. Juvenile very similar to adult, but with ochre ear-coverts.

Habitat. Open wet forest, forest edge and clearings from 300 to 1200 m; particularly fond of exposed branches on emergent trees in forest.

Food and Feeding. Preys primarily on insects, with a few lizards; in one study most of insects were dragonflies (Odonata). Hunts from exposed perch in dead tree or large open tree above forest canopy, at forest edge, or along stream or river. Prey captured in the air,

after swift, powerful attack flight; if prey missed, bird does not chase, but returns to perch. Often hunts in small groups of up to 6 individuals. One function of communal hunting may be defence against predators, as one group gave alarm calls when a Besra (*Accipiter virgatus*) was sighted; may also serve for teaching young birds which insects are suitable for capture; young may continue to hunt with their parents in group until the next breeding season.

Breeding. Usually Mar-May; copulation seen in mid-Feb. Nests in old barbet or woodpecker holes in dead trees, usually 6-8 m above ground. Groups of 3-4 fledglings recorded. Adults vigorous in defence of nest. No further information available.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES II. Fairly common to common in forest habitat. Not immediately threatened overall, but extirpated from many areas which have suffered comprehensive deforestation.

Bibliography. Brown & Amadon (1968), Dickinson *et al.* (1991), DuPont (1971), Gonzalez (1983), McGregor (1909-1910), Meyer de Schauensee & DuPont (1962), Miranda (1991), Parkes (1973), Potter (1953), Rabor (1938, 1977), Rand & Rabor (1960), Wolfe (1938).

24. Pied Falconet

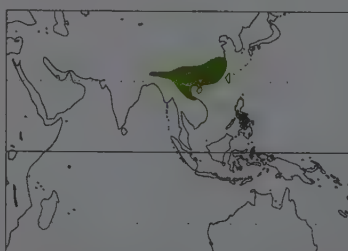
Microhierax melanoleucus

French: Fauconnet noir et blanc **German:** Elsterfalkchen **Spanish:** Falconete Pío
Other common names: White-legged Falconet

Taxonomy. *Ierax melanoleucus* Blyth, 1843, Assam.

Monotypic.

Distribution. NE India (Assam) E across S China to Zhejiang, and S to N Laos and N & C Vietnam.



Descriptive notes. 18-20 cm; 55-75 g; wing-span 35-37 cm. Largest of *Microhierax* falconets; black above and white below, lacking any rufous; forehead sometimes white, sometimes blackish; white supercilium separates from *M. erythrogenys*. Juvenile similar to adults.

Habitat. Forest edge and open areas of moist-deciduous and evergreen forest; also recorded in tea plantations. Occurs from sea-level up to 1500 m.

Food and Feeding. Preys on large insects, particularly butterflies, dragonflies and grasshoppers; also small to medium-sized birds;

reported to take lizards and small mammals on ground. Hunts from an exposed perch in a dead tree or large open tree above forest canopy, at forest edge, or along stream or river; does not remain at any perch for long period, but perpetually moves to new perches. Prey captured in the air after swift, powerful, shrike-like attack flight. Has been observed in small hunting groups typical of genus.

Breeding. Laying usually Mar-May. Nests in old barbet or woodpecker holes 13-30 m above ground. Clutch size unknown, but usually 3-4 fledglings. Adults aggressive in nest defence. No further information available.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Fairly common to uncommon; adaptability to habitats transformed by man, along with varied diet, suggests species unlikely to be in immediate danger.

Bibliography. Ali & Ripley (1978), Andrew (1992), Brown & Amadon (1968), Cheng Tso-hin (1987), Etchécopar & Hue (1978), King *et al.* (1975), Meyer de Schauensee (1984), Ripley (1982).



Genus *FALCO* Linnaeus, 1758

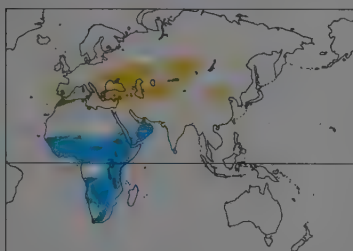
25. Lesser Kestrel

Falco naumanni

French: Faucon crécerellette German: Rötelfalke Spanish: Cernícalo Primilla

Taxonomy. *Falco Naumanni* Fleischer, 1818, southern Germany and Switzerland; error = Sicily. Monotypic.

Distribution. SW Europe and N Africa E through E Europe, Asia Minor and Iran to Mongolia and N China (E to Shandong). Winters in Africa S of Sahara; also and irregularly in parts of S Asia.



Descriptive notes. 29-32 cm; male 90-172 g, female 138-208 g; wingspan 58-72 cm. Unspotted above; greater upperwing-coverts blue-grey; underparts less spotted than in *F. tinnunculus*. Female very similar to that of *F. tinnunculus*, but slightly smaller; with claws white, not black; central two rectrices protrude slightly. Juvenile almost identical to female.

Habitat. Open areas in hot, dry climates; little or low vegetation, e.g. steppe, pastures, semi-desert, extensive cultivation; also in and around towns. Normally in flat or undulating terrain in lowlands, although in Asia regularly breeds up to 1500 m. In winter affects savanna, steppe, low scrub and cultivation. Highly dependent on presence of buildings or rock faces on which to nest. During migration and in winter quarters, large numbers gather at roosts in old buildings, or suitable trees; sometimes thousands of birds congregate.

Food and Feeding. Fair variety of aerial and terrestrial insects, often constituting over 90% of prey. Mainly Orthoptera (grasshoppers, locusts, crickets) and large beetles; also other invertebrates, e.g. centipedes; in winter quarters, when abundant, consumes large quantities of flying termites, Orthoptera and flying ants. Vertebrates generally less important: small lizards and to lesser degree rodents, e.g. voles, mice, shrews; small birds and their fledglings. Flies low, stooping on prey in air or on ground; typically faces into wind and hangs without beating wings, or hovers briefly; also hunts from perch or even on ground. Hunts in groups; in Africa enormous gatherings may form, following swarming insects. Takes advantage of prey disturbed by grass or scrub fires, or by tractors turning soil. Can travel 1-7 km from breeding colony to feed, sometimes more.

Breeding. Laying mainly in May; in NW Africa and S Spain from mid-Apr. Colonial, normally in groups of no more than 25 pairs; sometimes, in past commonly, up to hundreds of pairs. Nests mainly in human constructions, e.g. large old buildings, houses, walls and ruins, in towns or on outskirts; also in natural sites, e.g. rock faces, clay banks and quarries. Nest placed in hollow or below eaves. Normally 3-6 eggs (average c. 4), laid at intervals of 2 days; replacement laying occurs; incubation 26-28 days, by both adults; both adults also feed chicks; chicks have first down white, second down creamy white; fledging c. 36 days; independence 1 week later. Hatching success 62-75%; on average 2 chicks fledge per clutch, although significant annual variations; annual survival about 67% for adults, 30% for juveniles. Sexually maturity in first year. Oldest recorded bird in captivity 11 years old.

Movements. Mainly trans-Saharan migrant, although some birds winter in NW Africa and in various regions of S Europe and S Asia, e.g. S Spain, S Turkey, Azerbaijan; occurrence in India, and perhaps in Burma, probably refers to birds on passage, with only stragglers overwintering. Most birds migrate to S Africa. Nomadic movements in winter related to local concentrations of insects. Following post-breeding dispersal, birds fly to winter quarters, mainly in Sept; return to breeding areas varies with latitude, Feb in Morocco, Mar-Apr in Europe; juveniles return later. Migrates across broad front, often in large flocks, sometimes mixed with *F. vespertinus* or *F. tinnunculus*.

Status and Conservation. RARE. CITES II. Drastic and apparently widespread decline in second half of 20th century. In 1980's only important populations in Europe were: 4200-5100 pairs in Spain (end 1980's); not more than 150 pairs in Portugal (end 1980's); estimated 320-400 pairs in Italy; 120-130 pairs in Romania; and 2000 pairs in Greece estimated in early 1980's, with marked decline later. Little information regarding populations in Asia and former USSR, where status appears worrying, although estimated 1500-2000 pairs in Georgia and Azerbaijan in early 1990's; now very rare in S Ukraine, with rapid decline due to exploitation of steppes; apparently still numerous in parts of former USSR, e.g. Kazakhstan. Estimated 3000-4000 pairs in Turkey (1993); 300 pairs in Israel in early 1980's, where recovering after near extinction due to rodenticide poisoning. Perhaps 1000 pairs in Morocco in 1980's; in South Africa 154,000 birds counted in winter census of roosts in 1967, but by mid-1980's numbers possibly reduced by half. Causes of decline include: massive use of pesticides, resulting in drastic reduction in prey, poisoning, and reduced breeding success during period of DDT use; rebuilding or demolition of old buildings habitually used for nesting, leading sometimes to disappearance of colonies; habitat loss, through intensification of agriculture, desertification and overgrazing in winter quarters, etc. Since 1980's, successful protection measures, including: control of refurbishing of buildings hosting colonies; installation of artificial nests; and in some areas reintroduction. As result, some populations stable or increasing, at least locally.

Bibliography. Ali & Ripley (1978), Andrada & Franco (1975), Barnes (1993), Bergier (1987), Bernis (1980), Biber (1990), Bijnlsma *et al.* (1988), Bird & Bowman (1987), Blondel (1964), Brazil (1991), Brown *et al.* (1982), Burton & Boyer (1989), Cheng Tso-hin (1987), Collar & Andrew (1988), Cramp & Simmons (1980), Crick & Jones (1992), Dementiev & Gladkov (1951), Domázar *et al.* (1991, 1992, 1993), Eichéopar & Hue (1978), Flint *et al.* (1984), Franco (1980, 1982), Franco & Andrada (1976), Genschel (1986), Ginn *et al.* (1989), González & Merino (1991), Goodman *et al.* (1989), Handrinos & Demetropoulos (1983), Hiraldo, Negro & Domázar (1991), Hollom *et al.* (1988), Iankov, Petrov *et al.* (1994), Kemp & Crowe (1993), Knyshtaus (1993), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Meyer de Schauensee (1984), Negro (1991a, 1991b), Negro & Hiraldo (1992, 1993), Negro, Domázar & Hiraldo (1992, 1993), Negro, de la Riva & Bustamante (1991), Patkinev (1993), Paz (1987), Pereira (1984), Pickford *et al.* (1989), Piechowski *et al.* (1981), Pinto (1983), Richardson (1990), Ripley (1982), Roberts (1991),

Rogacheva (1992), Siegfried & Skead (1971), Simeonov *et al.* (1990), Thiollay (1989c), Zollinger & Hagemeijer (1994).

26. Common Kestrel

Falco tinnunculus

French: Faucon crécerelle German: Turmfalke Spanish: Cernícalo Vulgar
Other common names: European/Eurasian/Rock Kestrel

Taxonomy. *Falco Tinnunculus* Linnaeus, 1758, Sweden.

May form superspecies with *F. sparverius*, with *F. newtoni*, *F. punctatus* and *F. araea*, and with *F. moluccensis* and *F. cenchroides*. Several races poorly differentiated, and may be invalid. Eleven subspecies normally recognized.

Subspecies and Distribution.

F. t. tinnunculus Linnaeus, 1758 - N Africa, Europe and Middle East E to E Siberia and Soviet Far East.

F. t. interstinctus McClelland, 1840 - Tibet E through N Indochina and S & C China to Korea and Japan; winters S to India, Malay Peninsula and Philippines.

F. t. oburgatus (Stuart Baker, 1927) - S India (W & E Ghats) and Sri Lanka.

F. t. canariensis (Koenig, 1890) - Madeira and W Canary Is.

F. t. dacotiae Hartert, 1913 - E Canary Is.

F. t. neglectus Schlegel, 1873 - N Cape Verde Is.

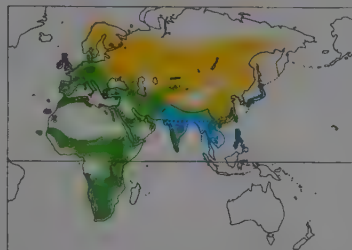
F. t. alexandri Bourne, 1955 - SE Cape Verde Is.

F. t. rupicolaeformis (C. L. Brehm, 1855) - NE Africa and Arabia.

F. t. archerii Hartert & Neumann, 1932 - Somalia, coastal Kenya and Socotra.

F. t. rufescens Swainson, 1837 - W & C Africa, E to Ethiopia and S to S Tanzania and N Angola.

F. t. rupicolus Daudin, 1800 - N Angola, S Zaire and S Tanzania S to S South Africa.



Descriptive notes. 32-39 cm; male 136-252 g, female 154-314 g; wingspan 65-82 cm. Head and tail grey, with subterminal black band on tail; outer half of upperwing dark; rest of upperwing and back chestnut spotted black; pale underparts also spotted, especially on breast and underwing-coverts. Female generally more uniformly coloured and more heavily spotted, lacking grey areas; barred tail. Juvenile very similar to female; broader streaks below; cere, legs and feet paler. Races separated on coloration, density of markings, tail pattern and size; African forms generally darker and more rufous; races of tropics and

S Africa show reduced sexual dimorphism.

Habitat. Adaptable to great variety of open or moderately wooded terrains, normally with herbaceous vegetation or low shrubs; grassland, steppe and even sub-desert, moorland, cultivation, wetlands with light vegetation; also in villages, towns and even cities, on outskirts and in lightly built-up areas. From coast to pastures above tree-line in mountains, occasionally reaching 4500 m. Requires suitable sites on which to perch and roost, e.g. trees, telegraph poles, buildings, rock faces.

Food and Feeding. Mainly small mammals, in Europe up to 90% voles, with some mice and shrews; open area passerines normally less important, although fledglings often seasonally important; also lizards and insects, e.g. beetles, grasshoppers, locusts, crickets; other invertebrates, e.g. earthworms. In Mediterranean and Africa, insects may predominate or be very important, even in terms of biomass, especially beetles, locusts, termite alates and solifugids; to lesser extent, lizards. Normally hunts from rather low flight or from perch, carefully surveying the ground; frequent characteristic hovering flight to detect small mammals and other terrestrial prey. Prey taken in air mainly insects, also birds and sometimes bats.

Breeding. Laying dates very variable. In Europe and Asia N of Himalayas normally lays Apr-May (Mar-Jun); very variable in Africa, often Aug-Dec S of Sahara, normally coinciding with dry season or S spring. Nest-site variable: ledges and holes in rock faces, quarries and buildings; trees, in holes or old nests of other birds, particularly corvids; sometimes in small colonies of up to several tens of pairs. Normally 3-6 eggs (1-7), laid at intervals of 2 days; replacement laying occurs; incubation 27-31 days, by female; in first phase of nestling period only male brings food; chicks have first down white, second down buff-grey; fledging 27-35 days; chicks dependent on adults and fed 2-4 weeks more. Breeding success variable: in Britain average 3-7 chicks fledge per successful pair, but perhaps only 2-5 per breeding pair; breeding success often related to abundance of voles. Sexual maturity during first year. Mortality c. 50-70% in first year, c. 30-40% in later years. Oldest recorded bird 16 years.

Movements. Nominate race migratory in N and E of breeding range; sedentary or dispersive in rest of range, although partially migratory in C Europe and elsewhere at middle latitudes; large numbers of migrants cross to Africa, moving S to Angola and Zimbabwe. Race *interstinctus* migratory in most of range, wintering in coastal China, Korea and Japan, and S to India and Indochina. Other races sedentary or dispersive; juveniles generally dispersive, even in sedentary populations.

Status and Conservation. Not globally threatened. CITES II. Commonest diurnal raptor throughout much of range, at least in W Europe and NW Africa. Some decline following generalized use of organochlorine insecticides and other pesticides, mainly in 1950's and 1960's; however, decline much less severe than in other raptors, e.g. Eurasian Sparrowhawk (*Accipiter nisus*); recovery detected, following restriction or banning of these products. In 1980's and early 1990's population changes in much of Europe seem to be result of natural fluctuations, due to factors such as abundance of rodents or cold winters. However, not all populations so healthy, and species in decline in former USSR, especially in S. Total population estimated at 1,000,000-2,000,000 pairs; population of Europe (excluding former USSR) estimated at 192,000-340,000 pairs; in European Russia perhaps 60,000 pairs. In 1990, Canary Is held c. 400 pairs of race *dacotiae* and perhaps over 4000 pairs of race *canariensis*.

Bibliography. Ali & Ripley (1978), Beukeboom *et al.* (1988), Bird & Bowman (1987), Bonin & Strenna (1986), Brazil (1991), Brown *et al.* (1982), Cavé (1968), Cramp & Simmons (1980), Davis (1975), Delov & Stoyanov (1994), Dijkstra (1988), Eichéopar & Hue (1978), Flint *et al.* (1984), Genschel (1986), Ginn *et al.* (1989), Glutz

On following pages: 27. Madagascar Kestrel (*Falco newtoni*); 28. Mauritius Kestrel (*Falco punctatus*); 29. Seychelles Kestrel (*Falco araea*); 30. Spotted Kestrel (*Falco moluccensis*); 31. Australian Kestrel (*Falco cenchroides*); 32. American Kestrel (*Falco sparverius*); 33. Greater Kestrel (*Falco rupicoloides*); 34. Fox Kestrel (*Falco alopecurus*); 35. Grey Kestrel (*Falco ardosiaceus*); 36. Dickinson's Kestrel (*Falco dickinsoni*); 37. Banded Kestrel (*Falco zoniventris*).

von Blotzheim *et al.* (1971), Goodman *et al.* (1989), Handrinos & Demetropoulos (1983), Hasenclever *et al.* (1989), Iñáñes & Korpimäki (1987), Kemp & Crowe (1993), Keymer *et al.* (1981), Kirkwood (1980, 1981a, 1981b), Korpimäki (1985, 1986), Kostzowa (1988), Kostzowa & Kostzowa (1987, 1990, 1991, 1994), Mackworth Praed & Grant (1962), Maclean (1993), van Marle & Voous (1988), Masman (1986), Masman & Klaassen (1987), Masman, Daan & Beldhuis (1988), Masman, Daan & Dijkstra (1988), Masman, Gordijn *et al.* (1986), Meijer (1988), Meijer *et al.* (1990), Newton, Bell & Wyllie (1981), Nielsen (1983), Noer & Secher (1983), O'Connor (1982), Packham (1985), Palmer (1988), Palokangas *et al.* (1992), Paz (1987), Peter & Zamsel (1982), Petersen (1956), Petitfor (1983a, 1983b), Piechocki (1982), Reichhoff (1977), Richardson (1990), Riddle (1979), Rijnsdorp *et al.* (1981), Roberts (1991), Rockenbach (1968), Rogacheva (1992), Simeonov *et al.* (1990), Smythies (1986), Thiollay (1963, 1978c), Tinbergen (1940), Village (1982a, 1982b, 1983a, 1983b, 1989, 1990), Village *et al.* (1980), Wallin *et al.* (1983), Wiklund & Village (1992), Yalden & Warburton (1979), Young, J.G. (1973), Zande & Verstraël (1985).

27. Madagascar Kestrel

Falco newtoni

French: Crécerelle malgache **German:** Madagaskarfalke **Spanish:** Cernícalo de Aldabra
Other common names: Newton's Kestrel, Aldabra Kestrel

Taxonomy. *Tinnunculus newtoni* Gurney, 1863, Madagascar.

Considered closest to *F. punctatus* and *F. araea* in the *F. tinnunculus* species group. A separate race, *aldabranus*, sometimes recognized for birds from Aldabra Is. Monotypic.

Distribution. Madagascar and Aldabra Is; perhaps rare vagrant to the Comoro Is.



Descriptive notes. 25 cm; male 90–117 g, female 131–153 g. Occurs in two colour morphs: pale morph (c. 80% of birds) with upperparts rufous, head grey and underparts white, streaked with black on upper breast; rufous morph has head and neck very dark, and the back and underparts deep chestnut. Female similar, but generally browner overall and more heavily marked below. Juvenile similar to adult but flight-feathers edged buff and underparts more heavily streaked. Aldabran birds smaller and lighter, especially females, some of which have unmarked underparts.

Habitat. Open country to 1830 m, in areas of

natural grassland, but now mainly in cropland around towns and villages or along road verges; even roosts under eaves of buildings.

Food and feeding. Mainly insects, especially grasshoppers and beetles, but also takes small mammals, reptiles and some birds and frogs. Hunts mainly from low perches but also hovers in search of prey and hawks some insects in flight. Pumps tail up and down when perched. Often crepuscular in hunting, sometimes in company of *F. eleonorae* and *F. concolor*.

Breeding. Laying Sept–Nov. Nests in cavities in buildings, cliff faces and trees, among epiphytes and in old nests of Black Kite (*Milvus migrans*) and Pied Crow (*Corvus albus*). Usually 4 eggs; female does most incubation, being called off the nest for food by the male.

Movements. No regular movements reported, but appearance of vagrants on the Comoro Is suggests some dispersal.

Status and Conservation. Not globally threatened. CITES II; possible race *aldabranus* included on CITES I. Common and widespread on Madagascar, where cultivation, urbanization and deforestation have increased its habitat; total population reckoned to number c. 30,000–60,000 pairs in 1982. Recorded at about 1 bird every 4 km along roads in the deforested central highlands, but only every 48 km among the forested E lowlands, where *F. zoniventris* is commoner. Rare and local on the Aldabra atoll, where c. 100 pairs exist, possibly only recent colonists, since the advent of man with his buildings and palm trees, and also an associated increase in abundance of available old crow nests. Not known to be affected by pesticide use.

Bibliography. Benson (1960a), Benson & Penny (1971), Brown & Amadon (1968), Cade (1982), Dee (1986), Gaymer (1967), King (1978/79), Langrand (1990), Langrand & Meyburg (1984), Louette (1988), Milon *et al.* (1973), Penny (1974), Rund (1936), Siegfried & Frost (1970).

28. Mauritius Kestrel

Falco punctatus

French: Crécerelle de Maurice **German:** Mauritiusfalke **Spanish:** Cernícalo de la Mauricio

Taxonomy. *Falco punctatus* Temminck, 1821, Mauritius.

Considered closest to *F. newtoni* and *F. araea* in the *F. tinnunculus* species group. Probably also close to endemic kestrel species of Reunion, extinct since 17th century, but known from bones and some anecdotal accounts. Monotypic.

Distribution. Mauritius I. SW Indian Ocean.



Descriptive notes. 20–26 cm; male averages 178 g, female 231 g. A small stout kestrel with relatively short, rounded wings, a long tail and long legs and toes. Juvenile has facial skin blue-grey becoming yellow within a year; otherwise ages and sexes not readily distinguishable, possibly neotenic, with juvenile features persisting in adults.

Habitat. Originally occupied evergreen forest from seashore to the highest peaks, of which only a remnant patch remains in SW Mauritius. Recently induced to live in secondary forest and scrub.

Food and feeding. Mainly *Phelsuma* geckos,

augmented with other lizards, small birds, insects such as dragonflies, a few mice and shrews. Hunts mainly from a perch, usually below the canopy, snatching prey from trunks, branches, foliage or the ground in short strikes. May also soar or quarter over the canopy; sometimes hovers over more open habitat, hawks dragonflies in flight, or runs and hops through vegetation and along the ground in pursuit. Mean attack distance 13.3 m; 38% of attacks successful overall.

Breeding. Laying Aug–Nov. Nested originally in holes in cliff faces or large trees, but recently induced to breed in captivity and in artificial nestboxes. Usually 3 eggs (2–5); incubation 30 days; fledging 38–39 days; juveniles remain on the parental territory until the following breeding season. 17–22% annual mortality.

Movements. No regular movements expected within the small island range.

Status and Conservation. ENDANGERED. CITES I. One of the rarest birds in the world by 1974, when only two pairs remained in the wild, due to cumulative loss of forest habitat, pesticides and depredations of introduced hunters, including macaque monkeys, rats, cats and mongooses. Captive propagation since 1984 with innovative harvesting and management, including supplementary feeding, provision of artificial nestboxes, predator control and reintroduction to secondary habitats, raised population in the wild to at least 50 breeding pairs and over 200 birds by 1993 (see page 246). Despite the limited extent (4000 ha) of primary forest habitat that remains in the Black River Gorges of SW Mauritius, this effort has bolstered the remaining population, and enabled recolonization of the Bambous and Moka Mountains in E and N Mauritius. Pairs have a home range of c. 120 ha. The original population may have been no more than 300 pairs, and conservation activities continue, with a goal of at least 100 pairs. Was, and may still be, vulnerable to pesticide use.

Bibliography. Brown & Amadon (1968), Cade (1982), Cade & Jones (1993), Cheke (1987), Collar & Andrew (1988), Collar & Stuart (1985), Diamond (1987), Fox *et al.* (1993), Herremans (1990), Jones, C.G. (1981, 1984a, 1984b, 1987, 1991), Jones *et al.* (1991), King (1978/79), McKelvey (1978a, 1978b), Meinertzhagen (1912), Pasquier (1980a, 1980b), Staub (1971), Temple (1974a, 1974b, 1977, 1986, 1987).

29. Seychelles Kestrel

Falco araea

French: Crécerelle des Seychelles

Spanish: Cernícalo de las Seychelles

German: Seychellenfalke

Taxonomy. *Cerchneis araea* Oberholser, 1917, Seychelles.

Considered closest to *F. newtoni* and *F. punctatus* in the *F. tinnunculus* species group. Monotypic. **Distribution.** Islands of the Seychelles, W Indian Ocean. On Mahé and its satellites (St Anne, Cerf, Longue and probably Thérèse), Silhouette and North. Reintroduced to Praslin; vagrant to La Digue; and historically on Curieuse, Félicité, Marianne and possibly Sisters.



Descriptive notes. 15–23 cm; male averages 73 g, female 87 g. A very small falcon with a very dark head and a relatively long tail. Female slightly paler than male. Juvenile has paler facial skin and is spotted and streaked black on underparts.

Habitat. Dense secondary forest, the degraded original habitat on these hilly granitic islands; extends now to cultivated and open urban areas.

Food and feeding. Mainly lizards, especially *Mabuya* skinks and *Phelsuma* geckos, but the diet includes insects, small birds and mice. Hunts from perches, snatching prey from

trunks, branches, foliage or the ground. Not known to hover.

Breeding. Laying Aug–Oct. Nests in cavities, mainly (69%) in rock faces more than 200 m above sea-level; or on old Common Myna (*Acridotheres tristis*) nests at the base of coconut palm fronds at lower elevations; or on ledges on buildings or in holes in trees. 2–3 eggs; incubation 28–31 days; fledging 35–42 days; post-fledging dependence 9–24 weeks. Most successful on cliffs (76%), less so on trees and buildings (68–35%) and least in palms (19%). Some competition for sites with the introduced Barn Owl (*Tyto alba*) and Common Myna, which, with the black rat (*Rattus rattus*), are also important nest predators.

Movements. No movement expected within the restricted island habitats, except for some dispersion between islands.

Status and Conservation. Not globally threatened. CITES I. Total population estimated at 420 pairs: 370 on Mahé in 1976, probably at carrying capacity; and at least 10 re-established on Praslin by 1981; mean territory size of 40 ha. Well studied, showing high hatching success (90%); no special conservation action implemented other than translocation to Praslin. Has adapted well to lowlands altered by human occupation, nesting on coconut palms and buildings, although with lower success than on cliffs in natural areas. Not known to be affected by pesticide use.

Bibliography. Brown & Amadon (1968), Bullock (1990), Cade (1982), Collar & Stuart (1985), Feare *et al.* (1974), Gaymer *et al.* (1969), King (1978/79), Penny (1968, 1974), Temple (1977), Vesey-Fitzgerald (1940), Watson (1981, 1989, 1992b, 1993).

30. Spotted Kestrel

Falco moluccensis

French: Crécerelle des Moluques **German:** Molukkenfalke

Spanish: Cernícalo Moluqueño

Other common names: Moluccan Kestrel

Taxonomy. *Tinnunculus moluccensis* Bonaparte, 1850, Ambon.

Forms superspecies with *F. cenchroides* and probably also with rest of *F. tinnunculus* complex. Traditionally split into four additional races, with recognition of *bernsteini* (N Moluccas), *javanensis* (Java, Bali), *timorensis* (Timor) and *renschii* (Sumba). Two subspecies currently recognized.

Subspecies and Distribution.

F. m. moluccensis (Bonaparte, 1850) – Moluccas, from Morotai and Halmahera S to Buru, Seram and Seram Laut.

F. m. microbalia (Oberholser, 1919) – Sulawesi and surrounding small islands; Java and Lesser Sunda E to Tanimbar Is.



Descriptive notes. 28–33 cm. Similar to *F. tinnunculus* in size, plumage and habits, but darker, with less pronounced sexual dimorphism in size and plumage. Race *microbalia* paler, particularly on underparts; ear-coverts greyer.

Habitat. Open country, cultivation and urban areas throughout range; normally occurs up to 2200 m, but occasionally over 2800 m in mountains.

Food and Feeding. Small mammals, lizards, large insects and small birds. Hunting behaviour similar to that of *F. tinnunculus*; hunts from exposed perches and by hovering, in

both cases over open areas. Prey usually taken on ground.

Breeding. Not well known. Breeds Apr-Aug in Java; Mar-Sept on Flores; Mar-Aug in Sulawesi. Nests in old stick nests of other birds, or in holes in trees. Single recorded clutch of 4 eggs. No further information available, but breeding biology likely to be similar to that of rather similar *F. tinnunculus*.

Movements. Apparently sedentary. Vagrant to Borneo.

Status and Conservation. Not globally threatened. CITES II. Widespread and common to uncommon; most numerous in lowlands.

Bibliography. Andrew (1985), Bishop *et al.* (1995), Bowler & Taylor (1989), Brown & Amadon (1968), Cade (1982), Gibbs (1990), Hoogerwerf (1965), MacKinnon (1988), MacKinnon & Philipps (1993), Mayr (1941), Smythies (1981), Stresemann (1940a), Thiollay & Meyburg (1988), White & Bruce (1986).

31. Australian Kestrel

Falco cenchroides

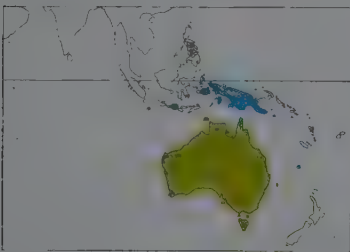
French: Crécerelle d'Australie **German:** Graubartfalke **Spanish:** Cernícalo Australiano
Other common names: Nankeen Kestrel

Taxonomy. *Falco Cenchroides* Vigors and Horsfield, 1827, New South Wales. Forms superspecies with *F. moluccensis*. Two subspecies recognized.

Subspecies and Distribution.

F. c. cenchroides Vigors & Horsfield, 1827 - Australia, Tasmania, Lord Howe I, Norfolk I and Christmas I (Indian Ocean). Winters irregularly from Lesser Sundas and Moluccas through Aru I and S New Guinea; occasionally to New Zealand.

F. c. baru Rand, 1940 - montane WC New Guinea.



Descriptive notes. 30-35 cm; 121-255 g; wingspan 66-78 cm. A typical small kestrel, paler than most. Female larger and heavier; has rufous head and tail. Juvenile often more rufous and more heavily marked. Males of New Guinea race *baru* have darker and more extensive grey head.

Habitat. All lightly wooded and treeless terrestrial habitats, including open woodland, savanna, grassland, farmland, beaches and urban areas; from sea-level up to 2000 m in Australia, to 3400 m in New Guinea. Nests in trees, buildings, caves and cliffs.

Food and Feeding. Mostly invertebrates, particularly insects such as grasshoppers and crickets; also small mammals (mice), birds up to size of sparrow and starling, and reptiles (mainly skinks), especially when breeding. Forages by high quartering and hovering, or still-hunting from perch. Seizes prey on ground by dive or glide; hawks flying insects; rarely chases small birds.

Breeding. Aug-Dec in Australia, Jul in New Guinea. Solitary; semi-colonial in concentrated breeding habitat amid extensive hunting habitat. Nests in variety of sites inaccessible to ground predators: from sink-holes and mine-shafts below ground, to tree hollows, old nests of other birds, cliffs and ledges on buildings and machinery, 2-31 m above ground. Eggs laid on depression or scrape. Usually 3-5 eggs (1-6); incubation 28-29 days; chicks have white down; fledging 31-35 days; post-fledging dependence up to 3 weeks. Nest success 68% of attempts; hatching success 66% of eggs laid; fledging success 45% of eggs laid; 1-6 young fledged per attempt. Sexually mature and sometimes breeds at 1 year. Oldest ringed bird 5 years.

Movements. Resident and partly migratory populations; many pairs sedentary in temperate regions. Birds breeding at high latitudes and altitudes tend to winter in coastal and lowland areas; many migrate N, some (mostly females) reaching New Guinea and Indonesia, W to Java and N to Moluccas. Also irruptive movements to arid regions after good rains and to local plagues of prey species.

Status and Conservation. Not globally threatened. CITES II. Widespread and abundant throughout Australia, where has increased in numbers; has benefited from agriculture and introduced prey. Has recently colonized several islands, including Lord Howe I, Norfolk I and Christmas I (Indian Ocean), and may be in process of colonizing New Zealand. Eggshell thickness not significantly reduced by DDT; seldom shot.

Bibliography. Baker-Gabb (1984b, 1985e), Beehler *et al.* (1986), Bollen (1991b), Coates (1985), Cupper & Cupper (1981), Dickman *et al.* (1991), Genelly (1978), Hollands (1984), Lewis, M.J. (1987), Marchant & Higgins (1993), Newgrain *et al.* (1993a), Olsen & Marples (1993), Olsen & Olsen (1980a, 1980b, 1987a, 1987b, 1987c), Olsen, Crome & Olsen (1993), Olsen, Vestjens & Olsen (1979), Paull (1991), Schodde & Tidemann (1988).

32. American Kestrel

Falco sparverius

French: Crécerelle d'Amérique **German:** Buntfalke **Spanish:** Cernícalo Americano
Other common names: American Sparrowhawk, Sparrow Hawk (1)

Taxonomy. *Falco sparverius* Linnaeus, 1758, America = South Carolina.

Has been placed in either *Cerchneis* or *Tinnunculus*. Often considered to form superspecies with *F. tinnunculus*. Seventeen subspecies normally recognized.

Subspecies and Distribution.

F. s. sparverius Linnaeus, 1758 - North America, from Alaska to Newfoundland, and S to W Mexico, except SE USA and coastal W Mexico; winters S through C America to Panama.

F. s. paulus (Howe & King, 1902) - South Carolina to Florida, USA.

F. s. peninsularis Mearns, 1892 - S Baja California, Sonora and Sinaloa, Mexico.

F. s. tropicalis (Griscom, 1930) - S Mexico to N Honduras.

F. s. nicaraguensis Howell, 1965 - lowland pine savannas in Honduras and Nicaragua.

F. s. sparveroides Vigors, 1827 - Cuba and I of Pines; Bahamas.

F. s. dominicensis Gmelin, 1788 - Hispaniola.

F. s. caribaeum Gmelin, 1788 - Puerto Rico to Grenada.

F. s. brevipes (Berlepsch, 1892) - Aruba, Curaçao and Bonaire (Netherlands Antilles).

F. s. isabellinus Swainson, 1837 - Venezuela to N Brazil.

F. s. ochraceus (Cory, 1915) - mountains of E Colombia and NW Venezuela.

F. s. caucae (Chapman, 1915) - mountains of W Colombia.

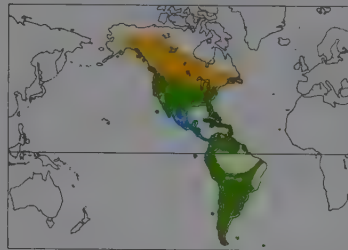
F. s. aequatorialis Mearns, 1892 - subtropical N Ecuador.

F. s. peruvianus (Cory, 1915) - subtropical SW Ecuador, Peru and N Chile.

F. s. fernandensis (Chapman, 1915) - Robinson Crusoe I (Más a Tierra), in Juan Fernández Is. off WC Chile.

F. s. cinnamominus Swainson, 1837 - SE Peru, Chile and Argentina S to Tierra del Fuego.

F. s. ceareue (Cory, 1915) - tablelands from NE Brazil S and W to E Bolivia.



Descriptive notes. 21-31 cm; male 80-143 g, larger female 84-165 g; wingspan 51-61 cm (all data from North America, but considerable variation throughout range). Sexually dimorphic in plumage. Male has blue wings, solid red tail with wide black tip, and underparts pale with spots; female brown with upperparts barred, underparts streaked and barred tail. Both sexes have conspicuous malar stripe and second stripe behind ear-coverts. Only *Falco* in which juveniles resemble adults in sexually dimorphic plumage; juvenile males generally have breast more heavily spotted and streaked than adult males. Races

vary mostly in colour, but also in size; *sparveroides* most distinctive with two colour morphs, one dark with red underparts, and one with white underparts.

Habitat. Ubiquitous. Most habitats except tundra, from tropical lowlands and deserts (even below sea-level) to near tree-line in mountains, at 3700 m in North America and 4300 m in South America; readily occupies urban centres. Common in altered, disturbed and agricultural land.

Food and Feeding. Largely insects (c. 60%) and small vertebrates, mainly small rodents, up to 89 g (c. 40%) in nominate *sparverius*. Lizards constitute 53% of diet in biomass, in tropical Caribbean populations. Lizards and insects are main food in tropical Venezuela and Costa Rica. In N Hemisphere deserts, small passerines may represent 35% (by biomass), small mammals 32% and lizards 28%. Hunting generally from perch, which is more successful (see page 232), with vantage point towards prey on or near ground, but up to 30% of attempts may be from flight; commonly hovers or hangs in updraughts. Highest success against prey on or near ground, and lowest success against aerial prey. Food often cached for later consumption. Some hunting takes place in family groups, as fledglings learn foraging skills.

Breeding. Somewhat dependent on latitude: Mar-Jul in North America; Mar-Jun in Cuba; Dec-Feb in Venezuela; may be double-brooded, especially if first brood early; in Chile first brood in Oct, second in Dec-Jan. Solitary. Some extra-pair copulation. No nest built; site variable from hole in tree, dirt bank or cliff, an unused stick nest e.g. of magpie (*Pica*), artificial nestbox, ledge on urban building, or depression in top of royal palms. Usually 4-6 eggs in N Hemisphere (average 4-8 in Canada, 4-0 in Florida), average 2-1 in Cuba and 3-7 in Venezuela; incubation 27-32 days; chicks have white down; fledging 29-31 days. Nest success: c. 67-89% in hatching; 72-89% in fledging; in double-brooded pairs average 85% success with first brood, and 73% with second brood. May breed at 1 year old. First year mortality c. 57%; average survival of 12-6 months. Oldest ringed bird 9 years 10 months.

Movements. Resident or sedentary over most of range. Race *sparverius*, from Alaska, Canada and N USA, moves S in winter: complex situation, but leap-frog migration suggested; birds from farthest N are longer range migrants; some birds move c. 2700 km, occurring S to at least Panama. Movement over water also occurs with birds from North America moving to Caribbean islands. Males tend to winter farther N than females; juveniles seemingly move farther than adults, and juvenile males disperse farther from natal areas than females. Vagrant to Falkland Is, with some birds overwintering.

Status and Conservation. Not globally threatened. CITES II. Ubiquitous, and perhaps commonest New World falconid overall. Expanding range and increasing numbers in many regions; invading urban areas, readily occupying artificial nestboxes. Wintering population of North America estimated at 236,000 birds, and total breeding population at 1,200,000 pairs. No reliable estimates for most of Neotropical range. Decreasing in parts of SE USA, e.g. Florida (with entire population of race *paulus*), because of habitat alterations; scarce or decreasing in some other regions of USA, e.g. Texas and Arkansas.

Bibliography. Alvarez & Lorenzo (1987), Alvarez & Montiel (1984), Bednarz *et al.* (1990), Balgooyen (1976, 1989), Beltzer (1990b), Blake (1977), Bird & Bowman (1987), Bloom & Hawks (1983), Bombardier (1992), Clark & Wheeler (1987), Collopy (1973), Contreras *et al.* (1990), Coonan (1986), Craig & Trost (1979), Cramp & Simmons (1980), Cruz (1976), Dathé (1971), Henderson (1960), Fjeldsa & Krabbe (1990), Fuller *et al.* (1987), Gurd & Bird (1990), Heinzelman (1964), Hilly & Brown (1986), Hiraldo, Delibes *et al.* (1991), Jakšic & Jiménez (1986), Jenkins (1969), Johnson (1990), Johnson (1965), Koplin (1973), McLaughlin & Roughgarden (1989), Palmer (1988), Parrish *et al.* (1987), Peakall & Kiff (1988), de la Peña (1992), Pinto (1964), Ridgely & Gwynne (1989), Roest (1957), Rudolph (1982), Sick (1985a, 1993), Simonetti *et al.* (1982), Slud (1964), Smallwood (1981, 1990), Smith *et al.* (1972), Snyder & Wiley (1976), Sparrowe (1972), Stiles & Skutch (1989), Stotz & Goodrich (1989), Toland (1984, 1985b), Towers (1990), Varland (1991), Varland & Loughin (1993), Varland *et al.* (1993), Wetmore (1965), Wheller (1992), Willoughby & Cade (1967), Wilmer (1982), Yáñez *et al.* (1980).

33. Greater Kestrel

Falco rupicoloides

French: Crécerelle aux yeux blancs **German:** Steppenfalke **Spanish:** Cernícalo Ojiblanco
Other common names: White-eyed Kestrel

Taxonomy. *Falco Rupicoloides* A. Smith, 1829, South Africa.

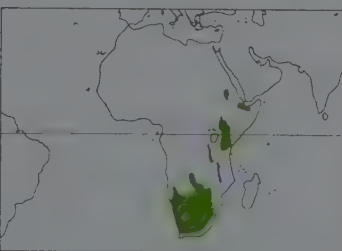
May form superspecies with *F. alopec*, but quite different in ecology and proportions. Three subspecies recognized.

Subspecies and Distribution.

F. r. fieldi (Elliot, 1897) - N & E Ethiopia, NW Somalia

F. r. arthuri (Gurney, 1884) - NE Tanzania, Kenya.

F. r. rupicoloides A. Smith, 1829 - Namibia, Botswana, SW Zambia and Zimbabwe to South Africa.



Descriptive notes. 33-36 cm; 181-334 g (S Africa), 178-252 g (E Africa); wingspan 84 cm. Only rufous kestrel with pale cream eye in adult. Barred flanks and upperparts with grey rump and tail distinctive. Most similar to female *F. naumanni*, but larger and heavier; more uniform coloration than *F. tinnunculus*. Sexes indistinguishable. Juvenile has rump and tail rufous, eye dark brown. Races differ mainly in size, with *arthuri* smaller, and *fieldi* smaller still and paler.

Habitat. Open desert, steppe and short grassland up to 2150 m. Requires a few scattered trees and bushes for roost- and nest-sites.

Food and feeding. Mainly arthropods, especially grasshoppers and solifugids, and small vertebrates, mainly birds and lizards. Hunts from a prominent perch or while hovering; during breeding, males deliver and make more strikes at large prey, especially birds, and females increasingly hover for arthropods. Occasionally makes fast aerial pursuits of flying birds and insects.

Breeding. Laying Jul-Feb (peak Sept-Oct) in S Africa; Jan-Nov (peak Apr-May) in E Africa; Apr-Jun in Somalia. Courtship includes flicker-diving displays with fast wingbeats, shrill cries and flashing of the white underwing. Uses an old nest of another bird, usually a corvid, especially Black Crow (*Corvus capensis*), but as large as a vulture or Secretarybird (*Sagittarius serpentarius*); nest placed low in a bush or high in a tree or electricity pylon, rarely in a tree cavity. Usually 3-4 eggs (2-7); incubation 32-33 days; chicks have first down cream, second down dark grey; fledging 30-34 days; female hunts for chicks in nest area and during the post-fledging period of at least 30 days.

Movements. Resident and territorial in many parts of its range, but nomadic in more arid areas, where only present during times of adequate rainfall and food. No regular movements described, but some movements of over 300 km recorded from ringing data. Enters taller grasslands during times of drought.

Status and Conservation. Not globally threatened. CITES II. Widespread and generally common in S Africa, with estimated 6000 pairs in Transvaal (South Africa), home range of 570-770 ha, and densities of 1 pair/16-29 km². Less common and more local in E and NE Africa. Benefits from bush clearing in more wooded areas, and provision of plantations and utility pylons in treeless areas, but still relies more on natural grasslands than exotic crops and pastures. Not known to be affected by pesticide use.

Bibliography. Ash & Miskell (1983), Brown, C.J. (1988d), Brown, C.J. *et al.* (1987), Brown, L.H. *et al.* (1982), Dean *et al.* (1968), Ginn *et al.* (1989), Hunt (1978), Hustler (1983c), Kemp (1978, 1984, 1991), Kemp & Crowe (1993), Kemp & Filmer (1989), Lewis & Pomeroy (1989), Mackworth-Praed & Grant (1957, 1962), Maclean (1993), Osborne & Colebrook-Robjent (1982), Pickford *et al.* (1989), Pinto (1983), Steyn (1982), Tarboton & Allan (1984).

34. Fox Kestrel

Falco alopex

French: Crécerelle renard

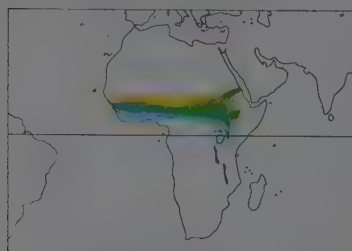
German: Fuchsfalke

Spanish: Cernícalo Zorro

Taxonomy. *Tinnunculus alopex* Heuglin, 1861, Gallabat, Sudan.

Possibly forms superspecies with *F. rupicoloides*, but quite different in ecology and proportions. Monotypic.

Distribution. Senegambia E through N Cameroon and Sudan to Red Sea coast of Ethiopia, S to NE Zaire, NW Kenya and NE Uganda.



Descriptive notes. 35-39 cm; 250-300 g. A large, long-tailed kestrel, deep chestnut all over, streaked with black. Size and uniform coloration differ from *F. tinnunculus* and *F. naumanni*. Sexes indistinguishable. Juvenile more heavily streaked, with broader black bars in tail.

Habitat. Rocky hills, cliffs and outcrops adjoining open arid Sahelian savanna, up to 2200 m.

Food and feeding. Large insects, small mammals, lizards and small birds reported as prey. Hunts from a perch, taking prey on ground, but also attracted to grass fires for grasshopper, but also attracted to grass fires for grasshopper, but also attracted to grass fires for grasshopper.

pers so disturbed and to emergences of termite alates which are taken on the wing. Long, broad wings and graduated tail suggest buoyant flight and good hovering ability; reported to remain on the wing for long periods, but species remains little known.

Breeding. Laying variable locally, Mar-May. Pairs soar and call near nest-site. Nests in cavities or on ledges in rock faces; may use same site in successive years. Several pairs may nest in close proximity, with 20-25 pairs breeding almost colonially, e.g. in NW Kenya. 2-3 eggs; only female recorded incubating; no other details recorded.

Movements. Sedentary in some intermediate areas, but generally moves S from drier areas across whole range in dry season (Oct-Mar) to attend bush fires, then N with rains to nest on rocky outcrops; some vagrants further S into Kenya, NE Tanzania and NE Zaire in Sept-Feb after breeding. Population breeding furthest S, in Turkana Valley (Kenya), may be resident.

Status and Conservation. Not globally threatened. CITES II. Little studied and may be vulnerable through limited and localized breeding range on rocky hills, although these eminences are usually less subject to habitat degradation than the surrounding savanna. Little pesticide use within its range.

Bibliography. Bannerman (1953), Bouet (1955), Brown, L.H. (1970a), Brown & Amadon (1968), Brown *et al.* (1982), Cade (1982), Lewis & Pomeroy (1989), Mackworth-Praed & Grant (1957, 1970), Pakenham (1979), Salvan (1968), Serle *et al.* (1977), Snow (1978).

35. Grey Kestrel

Falco ardosiaceus

French: Faucon ardoise

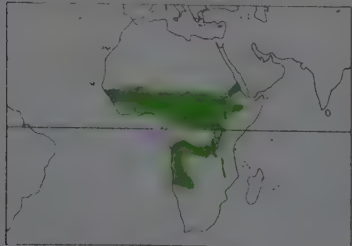
German: Graufalke

Spanish: Cernícalo Pizarroso

Taxonomy. *Falco Ardosiaceus* Vieillot, 1823, Senegal.

Sometimes united in subgenus *Dissodectes* with other grey kestrels *F. dickinsoni* and *F. zoniventris*. Monotypic.

Distribution. Senegambia E to Ethiopia and S through W Kenya and W Tanzania to Angola, N Zambia, N Namibia and NW Botswana.



Descriptive notes. 30-33 cm; male 205-255 g, female 240-300 g. Stocky, dark grey kestrel with a heavy bill. Plumper and shorter-winged than *F. concolor*, more heavily built and uniformly coloured than *F. dickinsoni* or *F. zoniventris*. Juvenile has pale green, not yellow, facial skin and a brown wash to plumage.

Habitat. Woodland and savanna with dense stands of large trees or palms, adjacent to the open glades or burnt areas preferred for hunting.

Food and feeding. Mainly grasshoppers and small reptiles, such as lizards, snakes and

chameleons; also small birds, rodents, bats, frogs, earthworms and many insects, including termite and ant alates, and other arthropods such as crabs and myriapods. Sometimes eats oil palm fruits. Hunts mostly from a high, open perch, especially during warmer part of day when main prey active; usually takes prey from the ground or low foliage. May also perform slow prospecting flight, fast aerial chase with rapid wingbeats, or aerial hawking of insects, but rarely hovers.

Breeding. Laying Jan-Apr in W Africa; Aug-Oct in S Kenya, Tanzania and Angola. Nest in tree cavities, old stick nests or most often cavities of old Hamerkop (*Scopus umbretta*) nests, even usurping active nests. 3-5 eggs; incubation c. 30 days; fledging c. 30 days. Pair will copulate and roost in nest when breeding.

Movements. Resident in most areas; no regular movements reported, and remains in vicinity of Hamerkop nests throughout the year in Kenya.

Status and Conservation. Not globally threatened. CITES II. Common in parts of range, e.g. W Africa and Angola; large areas of natural habitat remain, sometimes in nature reserves. Home range of 100-300 ha. May even have benefited from clearance of tropical rain forest, and often hunts on agricultural land. Not known to be affected by pesticide use.

Bibliography. Brown *et al.* (1982), Cade (1982), Ginn *et al.* (1989), Gore (1990), Lewis & Pomeroy (1989), Loosemore (1963), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Pakenham (1979), Pickford *et al.* (1989), Pinto (1983), Serle (1939, 1943), Sinclair & Dean (1974), Steyn (1982), Thiollay (1975a, 1976b, 1977c), Thiollay & Clobert (1990), Wells (1965), Wilson & Wilson (1983).

36. Dickinson's Kestrel

Falco dickinsoni

French: Faucon de Dickinson

German: Schwarzfückenfalke

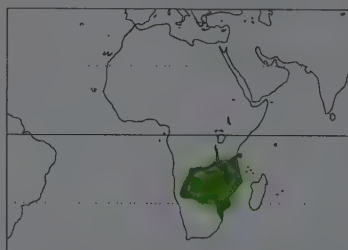
Spanish: Cernícalo Dorsinegro

Other common names: White-rumped Kestrel

Taxonomy. *Falco dickinsoni* P. L. Sclater, 1864, Chibasa, Shire River, Malawi.

Sometimes united in subgenus *Dissodectes* with other grey kestrels *F. ardosiaceus* and *F. zoniventris*; most similar in size and proportions to the latter. Monotypic.

Distribution. SC Africa, from Angola E through S Zaire to SC Tanzania (including Zanzibar and Pemba), and S to N Namibia, N Botswana and NE South Africa.



Descriptive notes. 28-30 cm; male 169-207 g, female 207-235 g; wingspan 67 cm. Whitish head, rump and narrow bars across tail distinctive. Individual variation in intensity of grey coloration, possibly with dark and light morphs. Bill less heavy than *F. ardosiaceus*, and not uniformly coloured as in *F. concolor*. Flies with fast, choppy wingbeats and on landing sometimes clings parrot-like on trees. Juvenile has facial skin pale green, not yellow, and plumage tinged brown.

Habitat. Wooded savanna or clumps of palm trees adjacent to patches of open grassland, scrub, swamp or floodplain.

Food and feeding. Mainly small birds, lizards and chameleons, together with insects, snakes, rodents, frogs, solifugids and crabs; bats taken at dusk. Hunts mainly from perch on dead tree and takes prey on the ground; sometimes performs fast aerial chases of birds, hawks insects or hovers. Attracted to bush and cane fires for small birds and insects flushed or confused by the smoke.

Breeding. Laying Jul-Nov (peak Sept-Oct). Nests in a cavity in a baobab (*Adansonia digitata*) or other large tree, palm stump or old Hamerkop (*Scopus umbretta*) nest; once nested in a bridge. Usually 3 eggs (1-4); incubation c. 30 days; chicks have pale grey first down, dark grey second down; fledging 33-35 days. Adults sometimes provision offspring from a cache.

Movements. Territorial pairs resident in many areas of C Africa. Some local movements reported, e.g. in Zimbabwe, especially at periphery of range, e.g. S Kenya (Jun-Aug). Botswana and Transvaal; in such cases enters new areas as ground cover recedes, leaving when it becomes too dense or too dry.

Status and Conservation. Not globally threatened. CITES II. Uncommon in much of range, but large areas of good habitat remain, some of it in national parks. Common on Pemba in 1970's. Often overlooked and may be patchily distributed in many areas, with only 50 pairs estimated for NE South Africa. Not known to be affected by pesticide use.

Bibliography. Benson & Benson (1975), Borello & Borello (1980), Brooke (1972), Brooke & Howells (1971), Brown *et al.* (1982), Cade (1982), Clancey (1968b), Colebrook-Robjent (1976), Colebrook-Robjent & Tanner (1978), Cook (1971), Ginn *et al.* (1989), Hammer (1978), Hammer & Blackwood (1982), Lewis & Pomeroy (1989), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Pakenham (1979), Pickford *et al.* (1989), Pinto (1983), Steyn (1982), Tarboton & Allan (1984).

37. Banded Kestrel

Falco zoniventris

French: Faucon à ventre rayé

German: Bindenfalke

Spanish: Cernícalo Malgache

Other common names: Barred Kestrel, Madagascar Banded Kestrel

Taxonomy. *Falco (Hypotriorchis) zoniventris* W. Peters, 1854, St Augustin Bay, Madagascar.

Sometimes united in subgenus *Dissodectes* with other grey kestrels *F. ardosiaceus* and *F. dickinsoni*; most similar to the latter. Monotypic.

Distribution. Madagascar.



Descriptive notes. 25-29 cm; c. 180-240 g. Underparts white, streaked with brown on the throat and upper breast, and barred with broad grey bands below. Female slightly darker than male. Eye pale yellow. Appears acuminated-like in flight and at rest, but heavy bill and large head distinctive. Plain underparts and dark eye distinguish migrant *F. concolor*. Juvenile undescribed.

Habitat. Favours forest edge and woodland up to 2000 m, including secondary forest, clearings and even dry woodland in S and SW Madagascar.

Food and feeding. Mainly arboreal lizards, especially chameleons and *Phelsuma* geckos, augmented by small birds and insects. Hunts from

a perch, within a radius of c. 150 m, and takes prey off branches, foliage or the ground; rarely hunts in flight after a swift dash through the foliage. Spends long periods perched on lower branches; hovers rarely, if at all.

Breeding. Laying Sept. Recorded nesting in tree cavities, scrapes among epiphytes on tall forest trees, or old nests of Sickle-billed Vanga (*Falculia palliata*). One clutch of three eggs. Courtship feeding observed at nest-sites.

Movements. No movements recorded within its limited island habitat.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Locally common but habitat limited and declining through deforestation. Not more than 1000 pairs predicted as total population, but able to exist in secondary habitats in some areas. Fairly common in W and S, rare in N and E, and absent from deforested central highlands. Not known to be affected by pesticide use.

Bibliography. Cade (1982), Colebrook-Robjent (1973), Dee (1986), Langrand (1990), Langrand & Meyburg (1984), Milon *et al.* (1973), Rand (1936).



ssp ruficollis

38

ssp chicquera

♂

39

♀

♂

40

♀

ssp columbarius

♂

♀

44

ssp suckleyi

♂

dark morph

41

42

43

pale morph

ssp pallidus

♂

46

47

48

49

50

45

52

53

54

51

dark morph

pale morph

PLATE 27

inches
cm

8
20

38. Red-necked Falcon

Falco chicquera

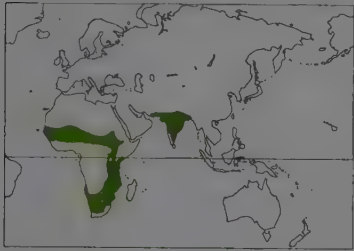
French: Faucon chicquera German: Rothalsfalke Spanish: Alcotán Turumti
Other common names: Red-headed Merlin/Falcon, Turumti

Taxonomy. *Falco chicquera* Daudin, 1800, Bengal.

Allied with *F. columbarius* on hunting behaviour, but probably not closely related, and eggs more hobby-like. African birds may not deserve separation into two races. Three subspecies recognized.

Subspecies and Distribution.

F. c. chicquera Daudin, 1800 - SE Iran E through Pakistan and India to Nepal and Bangladesh.
F. c. ruficollis Swainson, 1837 - Senegambia E to Ethiopia and S Somalia, then S to Zambia, Malawi and N Mozambique.
F. c. horsburghi Gunning & Roberts, 1911 - S of R Zambezi, from Zimbabwe and S Mozambique W to Botswana, Namibia and S Angola, and S to N South Africa.



Descriptive notes. 30-36 cm; male 139-178 g, female 190-305 g; wingspan 69 cm. Head and neck chestnut; tail grey barred black, with broad black subterminal bar and white tip. Juvenile plumage with brown wash. Considerably smaller than *F. biarmicus*, which has chestnut confined to crown. African races darker and more heavily marked, separated from each other on size, but larger specimens in S may be end of cline, rather than separate population.

Habitat. Patches of trees adjoining open country, from along watercourses in desert to *terai* to woodland surrounding open dambos.

Especially common in *Borussus* and *Hyphaene* palm savannas adjoining rivers, floodplains and coastal plains.

Food and feeding. Mainly small birds, of 10-150 g and up to the size of doves, and bats; also some rodents, reptiles, and insects, such as termite alates and locusts. A dashing hunter, with deep, rapid wingbeats. Most hunts started from a perch within cover, or close to the ground in open areas. Prey taken after aerial pursuit (sometimes over hundreds of metres), fast dashes behind cover or high ringing flights. Usually hunts in pairs, which later share prey, and sometimes in company of Gabar Goshawks (*Micronisus gabar*). Often attacks birds at water-holes; rarely pirates other raptors. Hunting success 29-31% overall.

Breeding. Laying mainly in dry season: Jan-May in India; Feb-Apr in Pakistan; Feb-May in Sahel zone; Jul-Aug in E Africa; May-Oct in S Africa. Nests in old nest-structure of a crow or other raptor, usually in a thorny tree (Pakistan, NE Kenya, SW Africa), or in a palm stump, or at the base of a palm frond. Usually 3 eggs in Africa, 4 in Pakistan (2-5); incubation 32-35 days; chick has white first and second down; fledging 35-40 days. Nests may be damaged by baboons.

Movements. Resident in many areas, but nomadic in others, in both Asia and Africa. Enters desert areas of SW Africa to feed on larks and other seed-eaters attracted by good rains; moves temporarily into better watered areas of W Transvaal during drought.

Status and Conservation. Not globally threatened. CITES II. Most common in areas of low rainfall. Easily overlooked, generally uncommon, but widespread; range includes several large nature reserves. Common on Deccan Plateau, EC India; widespread but uncommon in Pakistan; densities of 1 pair/2.6-83.3 km² in Zambia; and 1 pair/168 km² in Namib Desert. Not known to be affected by pesticide use.

Bibliography. Ali & Ripley (1978), Bednarek (1993), Brewster (1991), Brown, C.J. (1988d), Brown, L.H. *et al.* (1982), Cade (1982), Clark & Schmitt (1993), Colebrook-Robjent & Osborne (1974), Finch-Davies & Kemp (1980), Fry (1964), Ginn *et al.* (1989), Gore (1990), Guhrs & Osborne (1988), Herholdt (1994), Lewis & Pomeroy (1989), Mackworth-Præd & Grant (1962), Maclean (1993), Malan (1991), Malherbe (1963), Newby (1981), Olwagen (1984), Olwagen & Olwagen (1984), Osborne (1981, 1984), Pakenham (1979), Paxton & Brown (1984), Roberts (1991), Steyn (1982), Worden (1985).

39. Red-footed Falcon

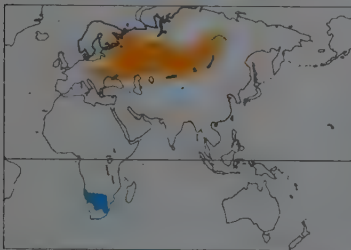
Falco vespertinus

French: Faucon kobez German: Rotfußfalke Spanish: Cernícalo Patirrojo
Other common names: Western Red-footed Falcon

Taxonomy. *Falco vespertinus* Linnaeus, 1766. Ingria = Province of St Petersburg.

Very close to *F. amurensis*, with which has frequently been considered conspecific; these two form superspecies. Monotypic.

Distribution. E Europe, from Estonia and Hungary, E through NC Asia to extreme NW China and upper R Lena. Winters mainly in SW Africa, from Angola, Namibia and N South Africa through Botswana to Zimbabwe and Zambia.



Descriptive notes. 28-31 cm; 130-197 g; wingspan 65-75 cm. Mostly slate grey, contrasting with chestnut lower belly, undertail-coverts and thighs; legs, cere and eye-ring red. Female very different, with rusty orange or yellowish underparts; upperparts and tail blue-grey with black transversal bands; head pale with rusty crown and blackish eye patch and slight moustache; bare parts orange. Male differs from that of *F. amurensis* by grey underwing-coverts, paler crown and mantle, and darker tail and underparts; female quite different from that of *F. amurensis*. Juvenile similar to that of *F. subbuteo*, but different build; forehead paler, crown and upperparts browner and divided by whitish collar on hindneck.

Habitat. Open habitats with some tree cover for perching, roosting and breeding. Steppe, wooded steppe, cultivation and pastures with stands or fringes of trees, or copses; e.g. riparian woodland; also orchards, marshy land; reaches open taiga. Normally in lowlands; although up to 1500 m in Asia. In African winter quarters, affects grassland, savanna and scrubland, roosting colonially, in groves of eucalypts and in towns or villages; up to thousands of birds together.

Food and Feeding. Mainly insects, especially Orthoptera (crickets, locusts, grasshoppers); also beetles, dragonflies, butterflies, moths, cicadas. Wide variety of invertebrates, but chicks may be mainly fed with vertebrates, e.g. fledglings of small birds, voles, mice, shrews, amphibians, lizards. In Hungary, mice and toads are important. In Africa, captures and eats flying ants and termites on wing, also locusts and grasshoppers. Most active around dawn and dusk. Hunts with fairly low flight, often over rivers, capturing insects; uses hovering flight to detect prey on ground; often drops down on insects from posts or wires.

Breeding. Laying mostly in May. Solitary or colonial, with 10's and up to 100's of pairs at colonies. Occupies old nests of corvids or raptors, preferring upper part of tree; sometimes in cliffs or tree holes, or even on ground protected by shrub. Normally 3-4 eggs (1-5), laid at intervals of 2 days; incubation possibly c. 27-28 days, by both adults; male brings food for chicks, as does female in later stages; chicks have first down white, second down greyish white; fledging from 27-30 days; independence from c. 1 week later. Sexual maturity in first year. Greater breeding success in colonies than for solitary pairs. Oldest recorded bird 12 years old.

Movements. Migratory, travelling great distances between Palearctic breeding areas and S African winter quarters. Migrates over broad fronts across Mediterranean; up to 5750 birds counted in autumn in Israel, and several thousand over NW Turkey in mid-May; main autumn route over E Mediterranean; spring migration further W. Stays in winter quarters mainly between Nov and late Feb; reaches breeding areas from mid-Apr to mid-May, most birds leaving in Sept.

Status and Conservation. Not globally threatened. CITES II. Marked decline, particularly in S of breeding range, probably due, directly or indirectly, to pesticide use. Estimates of c. 20,000 pairs in European Russia, but declining; in Byelorussia perhaps only 10-50 pairs in early 1990's, following drastic decline; quite common in Ukraine, especially in S. Generally scarce in rest of E Europe, where some small breeding nuclei have disappeared: 500-600 pairs in Hungary in 1970's, where population apparently stable in 1980's; in 1980's, perhaps c. 20 pairs in Bulgaria, and c. 80 pairs in Yugoslavia; 100-120 in Romania in 1970's. Still common in Asia; occasionally breeds in C Europe and even Scandinavia; local distribution within normal breeding range varies from year to year with food supply.

Bibliography. Brown *et al.* (1982), Cramp & Simmons (1980), Dementiev & Gladkov (1951), Etchécopar & Hue (1978), Flint *et al.* (1984), Fulop & Szilvka (1988), Günsel (1986), Ginn *et al.* (1989), Goodman *et al.* (1989), Handrinos & Demetropoulos (1983), Haraszy & Bagyura (1993), Horváth (1955, 1956, 1963, 1975), Kemp & Crowe (1993), Keve & Szilji (1957), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Martin, B.P. (1992), Meier Zwicky & Schmid (1990), Paz (1987), Pickford *et al.* (1989), Pinto (1983), Ragucheva (1992), Simeonov *et al.* (1990), Thiollay (1989c).

40. Amur Falcon

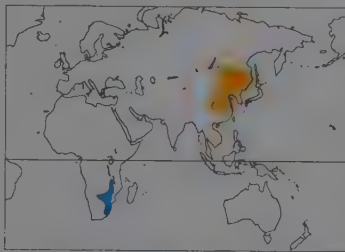
Falco amurensis

French: Faucon de l'Amour German: Amurfalke Spanish: Cernícalo del Amur
Other common names: Eastern Red-footed/Manchurian Red-footed/ Amur Red-footed Falcon

Taxonomy. *Falco vespertinus* var. *amurensis* Rudde, 1863, Zeya River, Amurland.

Very close to *F. vespertinus*, of which has frequently been considered subspecies, but differs in plumage, especially of female, morphology and behaviour; these two species form superspecies. Monotypic.

Distribution. Transbaikalia (SE Siberia) and NE Mongolia E to Amurland and S to N & E China and N Korea; has bred in Assam (NE India). Winters in S Africa, mainly from Malawi to Transvaal.



Descriptive notes. 28-30 cm; male 97-155 g, female 111-188 g. Male resembles that of *F. vespertinus*, but axillaries and underwing-coverts white. Female quite different from that of *F. vespertinus*, with crown and nape grey, larger blackish moustache, and underparts whitish, densely spotted black. Juvenile similar to female, but head and neck paler; upperwing-coverts and back edged rufous.

Habitat. Open wooded zones, sometimes with marshy areas; woods and margins of woodland, both coniferous and deciduous; avoids treeless steppes and dense forest. In winter, occurs in savanna and grassland, roosting colonially in clumps of trees; these roosts may be traditional, and may be used by hundreds and up to thousands of birds.

Food and Feeding. Mainly insects, such as locusts, grasshoppers, beetles; also small birds and some amphibians. In African winter quarters, feeds mainly on swarming termite and ant alates, which become abundant in association with tropical rainstorms, but also takes locusts and grasshoppers. Often hunts from perch on tree or power cables, and will rest for long periods on same perch; captures prey in air, but also on ground; sometimes uses hovering flight. Normally hunts more in early morning and late evening; outside breeding season often occurs in flocks.

Breeding. Lays in May-Jun. Solitary or in small colonies, in old nests of corvids, or in tree holes, in conifers or broad-leaved trees. Normally 3-4 eggs (2-6), laid at interval of 2 days; incubation probably c. 28-30 days; both adults incubate and feed chicks; fledging c. 1 month. Sexual maturity possible in first year, still with juvenile plumage.

Movements. Migratory, travelling massive distance between E Asia and S Africa. Often migrates in large groups, of up to thousands, sometimes in company of *F. naumanni* or other small falcons. Leaves N breeding grounds in second half of Sept; possibly flies over Indian Ocean, from India to E Africa; reaches winter quarters, mainly from Malawi S to Transvaal, in late Nov and early Dec; leaves late Feb and mainly Mar, and reaches breeding grounds in Apr and early May. See page 238.

Status and Conservation. Not globally threatened. CITES II. Size of population not known; may be stable; at least locally common, e.g. SE of L. Baikal and in Mongolia. Total of 892 birds counted

On following pages: 41. Eleonora's Falcon (*Falco eleonora*); 42. Sooty Falcon (*Falco concolor*); 43. Aplomado Falcon (*Falco femoralis*); 44. Merlin (*Falco columbarius*); 45. But Falcon (*Falco rufigularis*); 46. Orange-breasted Falcon (*Falco deatoleucus*); 47. Eurasian Hobby (*Falco subbuteo*); 48. African Hobby (*Falco cinerius*); 49. Oriental Hobby (*Falco severus*); 50. Australian Hobby (*Falco longipennis*); 51. New Zealand Falcon (*Falco novaeseelandiae*); 52. Brown Falcon (*Falco berigora*); 53. Grey Falcon (*Falco hypoleucos*); 54. Black Falcon (*Falco subgriseus*).

passing over Beidaihe (NE China) from late Aug to late Oct 1987. Visible in enormous flocks of up to 4000-5000 birds, at roosts in winter quarters; census of such roosts highly desirable, allowing at least approximate evaluations of total numbers, and perhaps eventually indications of trends.

Bibliography. Ali & Ripley (1978), Austin (1948), Benson (1951), Benson & Benson (1975), Brazil (1991), Brazil & Hanawa (1991), Brown *et al.* (1982), Cheng Tso-hin (1987), Clancey (1966), Crick & Jones (1992), Dementiev & Gladkov (1951), Etchécopar & Hue (1978), Flint *et al.* (1984), Ginn *et al.* (1989), Hines, C.J.H. (1987), Hollom *et al.* (1988), Inskipp & Inskipp (1985), Kemp & Crowe (1993), Knystautas (1993), Maclean (1993), Meyer de Schauensee (1984), Michell (1962), Pickford *et al.* (1989), Pinto (1983), Polushkin (1988), Ripley (1982), de Roder (1989), Rogacheva (1992), Shi Kun & Ding Han-lin (1988), Sinclair (1987), Sinclair & Whyte (1991), Smythies (1986).

41. Eleonora's Falcon

Falco eleonora

French: Faucon d'Éléonore **German:** Eleonorenfalk **Spanish:** Halcón de Eleonora

Taxonomy. *Falco Eleonora* Gené, 1839, Sardinia.

Sometimes considered to form superspecies with *F. concolor*. Monotypic.

Distribution. Islands and rocky coasts from Canary Is and NW Morocco E through Mediterranean to Lemnos, N Sporades, Cyclades, Dodecanese, Crete and Cyprus. Winters mainly in Madagascar, but also in E Africa and Mascarene Is.



Descriptive notes. 36-42 cm; male 350 g, female 388 g; wingspan 90-105 cm. Polymorphic, with pale and dark morphs and also some intermediates; from below, dark underwing-coverts contrast with paler flight-feathers. Commoner pale morph has throat and cheeks whitish, breast and belly cream-coloured to reddish brown streaked black. Dark morph all blackish. Female slightly larger. Juvenile also dimorphic, generally browner than corresponding adult plumages; pale morph paler than adult, underparts greyish with dark spots on underwing-coverts, and flight-feathers barred.

Habitat. Normally small islands and islets, typically uninhabited or very peaceful, on migratory routes of small birds; may appear on mainland coasts to hunt or during dispersal, but infrequently to nest. Breeds only within narrow latitudinal limits in Mediterranean zone. In winter quarters in Madagascar, occurs in and around open woodland and forest, as well as wetlands, paddyfields and lakes.

Food and Feeding. Large flying insects and small birds; specially adapted to take advantage of autumn migrations. Insects taken mainly outside migration peak, and in winter quarters; feeds on, e.g. Lepidoptera, Coleoptera, Odonata, Orthoptera and flying ants; insects eaten by bird in flight. Very wide range of birds taken, varying locally and seasonally: various warblers (*Phylloscopus*, *Sylvia*), shrikes (*Lanius*), Common Redstart (*Phoenicurus phoenicurus*), Common Nightingale (*Luscinia megarhynchos*), Spotted Flycatcher (*Muscicapa striata*), Whinchat (*Saxicola rubetra*); in Balearic Is, Eurasian Swift (*Apus apus*) commonly taken, especially fledglings; rarely hunts prey larger than Hoopoe (*Upupa epops*), which is locally important. Normally hunts birds over sea; in certain conditions several individuals will hover and form a barrier to intercept migrants. Before breeding, may travel tens of kilometres from colony to areas with greater abundance of insects or non-migratory birds, e.g. other islands, mainland coasts, often wetlands. Marked tendency to hunt crepuscularly; nocturnal hunting has been reported.

Breeding. Lays very late, mostly from mid-July to Aug, so that rearing of young coincides with autumn migration of small birds. Colonial, with up to 300 pairs together, though normally tens; nesting principally on islets. Nest-site in holes and ledges of sea cliffs, or on ground, under bushes or in crevices; distance between nests varies with space available, but sometimes only a few metres. Normally 2-3 eggs (1-4), laid at interval of 2-3 days; incubation 28-30 days, mainly by female; chicks have creamy white first down; fed on small birds; fledging c. 37 days; chicks can leave colony 2 weeks later. Breeding success varies annually and locally; 1.3-2.5 young fledged per breeding pair, and 1.6-2.6 per successful pair. Sexual maturity at 2-3 years.

Movements. Migratory. Leaves Mediterranean and Atlantic colonies from mid-Oct to early Nov, flying presumably over Mediterranean and Red Seas and Somalia, S to main winter quarters in Madagascar; some birds winter in E Africa and Mascarene Is, but little known. Presence in Madagascar coincides with rainy season, favouring abundance of insects; returns to breeding areas in late Apr and May. See page 238.

Status and Conservation. Not globally threatened. CITES II. No drastic changes noted in total population, apart from some natural fluctuations; local increases or declines dependent on human pressure. In 1980's, probably c. 4000 pairs distributed among c. 100 colonies, almost all in Mediterranean zone, especially in Aegean Sea: c. 2500 pairs in Greece; also sizeable population of 480-500 pairs in Italy; and over 500 pairs in Balearic Is in 1991. In Atlantic sector, 90 pairs in Morocco in 1986, and at least 65 pairs in Canary Is in late 1980's. Traditionally persecuted and exploited by local human populations, particularly through theft of chicks and eggs, mainly for food; also affected by tourist development, which leads to lower breeding success. In Morocco, decline in 1960's and 1970's due to human disturbance and persecution; seems stable in Canary Is; increased in Balearic Is during 1980's; stable in Italy, despite interference in breeding colonies. Main problems caused simply by lack of regard for species and its colonies; species has responded very well when protected effectively.

Bibliography. Araujo *et al.* (1977), Bateson & Nisbet (1961), Bergier (1987), Brown *et al.* (1982), Cant (1978), Cawement (1966), Clark, A.L. (1974, 1981), Cramp & Simmons (1980), Dolg & Dies (1987), Gænsbøl (1986), Ginn *et al.* (1989), Goodman *et al.* (1989), Handrinos & Demetropoulos (1983), Kemp & Crowe (1993), Krüper (1864), Langrand (1990), Mackworth-Præd & Grant (1957), Maclean (1993), Mayol (1977b), Milon *et al.* (1973), Moeci (1973), Paz (1987), Pickford *et al.* (1989), Ristow (1975), Ristow & Wink (1985), Ristow, Scharlau & Wink (1989), Ristow, Wink & Wink (1979, 1982, 1983), Ristow, Wink, Wink & Friemann (1983), Simeonov *et al.* (1990), Spina *et al.* (1987), Swatschek, Feldmann *et al.* (1994), Swatschek, Ristow *et al.* (1993), Thevenot *et al.* (1981), Vaughan (1961), Walter (1979a, 1979b), Wink, Biebach *et al.* (1993), Wink, Ristow & Wink (1979), Wink, Scharlau & Ristow (1987), Wink, Wink & Ristow (1978, 1980a, 1980b, 1982a, 1982b).

42. Sooty Falcon

Falco concolor

French: Faucon concolore **German:** Schieferfalk **Spanish:** Halcón Pizarroso

Taxonomy. *Falco concolor* Temminck, 1825, Senegal, etc. = Barqan Island, Gulf of Aqaba.

Sometimes considered to form superspecies with *F. eleonora*. Monotypic.

Distribution. E Libya through Egypt, Israel and Jordan to coasts of Red Sea and Persian Gulf, E to SW Pakistan. Winters in Madagascar, and also in SE Africa.



Descriptive notes. 32-36 cm; wingspan 78-90 cm. Medium-sized, all grey falcon. Considerably paler than dark morph of *F. eleonora*; slightly smaller, with more wedge-shaped tail. Larger than *F. ardosiaceus*, with longer wings and unbarred flight-feathers. Existence of purported dark morph from Red Sea zone now generally rejected. Juvenile very similar to juvenile *F. eleonora*.

Habitat. Rugged or mountainous desert areas with canyons, cliffs, or at least some small crags; hot, very arid zones, almost without vegetation; also small coral islands. In winter, much wetter areas, e.g. open wooded country,

savanna, edges of woods, marshy areas and paddyfields. From sea-level up to 1500 m in Madagascar.

Food and Feeding. In breeding season, mainly small birds on autumn migration, as native vertebrate fauna is very rare in breeding areas; occasionally bats and other vertebrates. In winter, mainly insects, e.g. locusts, grasshoppers, flying termites, flying ants, dragonflies. Birds taken include variety of small passerines, bee-eaters, Eurasian Golden Oriole (*Oriolus oriolus*), Hoopoe (*Upupa epops*), swallows, swifts, waders and small seabirds, such as petrels and terns. Searches for prey up to 5 km or more from nest, flying to oases or areas with some vegetation. Hunts alone or in pairs; in winter may hunt in small parties, sometimes in company of *F. eleonora*. Birds mainly captured in air, species stooping in flight or from prominent perch; also flies low to flush prey, and in winter hawks insects from perches. Hunts mainly at dawn and dusk.

Breeding. Laying in Jul-Aug, with raising of chicks timed to coincide with peak in migration of small birds. Solitary or in loose colonies; up to 100 pairs on small islands in Red Sea and Gulf of Oman, with at least 40 m between nests; in Negev Desert (Israel), normally 2-5 km between pairs, but in areas of desert with few suitable nest-sites, nests up to tens of kilometres apart. Nests in cracks or hollows in upper part of cliffs, sometimes in old nests of ravens; sometimes in rocky or coral outcrops; on islands, also nests on ground, under bushes; same nest-site may be reused repeatedly. Normally 2-3 eggs (1-4); incubation 27-29 days, mainly by female; male hunts alone until 2 weeks after chicks have hatched; chicks have white down; fledging 32-38 days; chicks fed some weeks more. Up to 4 chicks fledge, but normally 2-3, with mean of 2.34 per successful pair. At least in some cases, species can breed successfully at one year old.

Movements. Migratory, wintering mainly in Madagascar; also, to lesser extent, on African mainland, in coastal Mozambique and E South Africa, with some birds perhaps further inland. Arrives in Madagascar from late Oct; last birds leave in early May, arriving in breeding areas mainly in Apr, in Israel from late Apr. Rare spring passage migrant to NW Somalia, where often claimed to breed.

Status and Conservation. Not globally threatened. CITES II. Numbers possibly stable. Indirect estimates of total population have been made, based on greater numbers than *F. eleonora* in shared winter quarters: present species found to outnumber *F. eleonora* 10:1, giving estimate of 5000 birds in 1000 km² in W Madagascar. Based on total population of 4000 pairs of *F. eleonora* in 1980's, present species might number c. 40,000 pairs; however, this figure does not correspond at all with normally very low density of species within breeding range, although breeding populations still very little known. At least c. 100 pairs in 1980's in Israel, where previously considered very rare.

Bibliography. Ali & Ripley (1978), Baha El Din (1984), Booth (1961), Brown *et al.* (1982), Clancey (1968a), Cramp & Simmons (1980), Frumkin (1984, 1986, 1988a, 1993), Frumkin & Pinshow (1983), Gaucher, Daunicht & Eichacker (1994), Gaucher, Petit & Symens (1988), Gænsbøl (1986), Ginn *et al.* (1989), Goodman *et al.* (1989), Kemp & Crowe (1993), Langrand (1990), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Moreau (1969), Milon *et al.* (1973), Paz (1987), Pickford *et al.* (1989), Richardson (1990), Roberts (1991), Walter (1979c).

43. Aplomado Falcon

Falco femoralis

French: Faucon aplomado **German:** Aplomadofalk **Spanish:** Halcón Aleto

Taxonomy. *Falco femoralis* Temminck, 1822, Brazil.

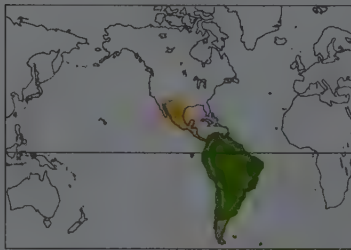
Has been known as *F. fuscoaculeus*, but this form is unidentifiable. Closely allied to *F. deiroleucus* and *F. ruficularis*. Three subspecies recognized.

Subspecies and Distribution.

F. f. septentrionalis Todd, 1916 - S USA (Arizona, New Mexico and Texas) S locally through Mexico to Guatemala.

F. f. femoralis Temminck, 1822 - Nicaragua and Belize through Panama to Colombia, E to the Guianas, and S through E Bolivia and Brazil to Argentina, extending S to Tierra del Fuego.

F. f. pichinchae Chapman, 1925 - temperate zones of SW Colombia, Ecuador, Peru and W Bolivia S to N Chile and NW Argentina (Tucumán).



Descriptive notes. Male 37-38 cm, average 261 g; female 43-45 cm, average 407 g. Tail rather long, in comparison with other falcons. Dark or bluish slate above; pale supercilium extends from behind eye onto russet nape; whitish throat and cheek patches separated by dark malar stripe; breast buff, with band across belly blackish barred white; vent, undertail-coverts and thighs rufous; tail blackish, with five off-white bands and white tip. Iris dark brown to yellowish brown, cere and legs pale yellow. Female similar, but significantly larger. Immature blackish brown above; underside breast and belly whiter than in adult.

Subspecies. breast streaked blackish; tail bars less distinct. Race *septentrionalis* larger and paler overall; race *pichinchae* darkest, larger than nominate, with breast band incomplete.

Habitat. Grassland, savanna and shrub-steppe in wide variety of climatic regimes, from moist tropical lowlands and dry savannas to Altiplano and puna in Andes, and comparable habitat in Tierra del Fuego; occurs up to 4000 m.

Food and Feeding. Claimed to feed heavily on insects and rodents; more detailed studies show birds as staple diet, with some rodents, bats, insects and lizards; insects numerically important.

but only c. 6% by biomass. Very poorly studied in South America: one study in C Chile gave mostly birds (56% by number, 97% by biomass). In Mexico, 50 bird species reported as prey. Prey includes large birds, e.g. teal, tinamous, chachalacas, pigeons and grackles; on average, avian prey items weigh 88 g. Most birds taken early in day, followed by long bouts of hawking insects. Most commonly captures prey by perch-hunting. Very rarely hunts by stooping from soar; consequently, does not take faster-flying birds, e.g. swifts. Pirates food from other raptors e.g. *F. sparverius*, White-tailed Kite (*Elanus leucurus*). One individual said to have stolen crayfish from herons. Often forages at grass fires. Hunts in tandem: 29% of all hunts recorded, and 66% of attempts to capture birds, in tandem; 45% success in capturing birds by tandem hunting, but only 21% when solitary. Male often initiates attacks on distant prey spotted from perch; if female does not follow, male calls her. Female will burst into shrubs to flush out birds; if prey not easily flushed, female pursues on ground while male hovers overhead. Eight young birds, reared in captivity, hunted together when released into the wild in Texas. Uneaten prey cached; cache sites defended from other predators.

Breeding. Very poorly known. Nest in dry season, Venezuela: eggs in Nov, Argentina. Uses abandoned nests of corvids (*Psittorhinus*, *Corvus*) or other raptors (*Elanus*, *Buteo*); one pair nested repeatedly in abandoned nests in active colony of *Milvago chimango*. Usually 2-3 eggs (up to 4); incubation 31-32 days (1 nest), by both sexes; fledging 4-5 weeks. In Venezuela, 1 nest produced 3 young.

Movements. C American populations predominantly migratory, although some overwinter (in Belize); some birds in Panama seem to be resident. Non-migratory through central part of range; appears in small migrant flocks in SE Brazil in Aug, but source of these birds, and resident or migratory status of southernmost populations remain to be confirmed.

Status and Conservation. Not globally threatened. CITES II. Throughout most of its extensive range, populations stable or perhaps increasing, where deforestation is opening up new grassland habitat. Only occasionally reportedly from Guatemala. Virtually eliminated for poorly understood reasons in S USA and N Mexico; decline may have started as early as 1909, but species probably nested until 1950's; probably related to habitat change associated with cattle grazing and invasion of mesquite, although recent improvements in the habitat have not led to population increase. Significant DDT contamination and eggshell thinning reported in E Mexico. In Panama, increased area of sugar cane cultivation and spreading human population may explain apparent recent slump there. Declines reported in S Argentina in areas where pesticide use has been poorly controlled (if at all). Captive breeding and reintroduction programme being carried out in N of range by Peregrine Fund (see page 247).

Bibliography. Blake (1977), Bond (1972), Brooks (1933), Cade (1982), Clark *et al.* (1989), Contreras *et al.* (1990), Donazar, Ceballos *et al.* (1993), Ehrlich *et al.* (1992), Ellis (1992), Fjeldså & Krabbe (1990), Fraga & Salvador (1986), Friedmann (1950), Haverschmidt (1968), Hector (1980, 1981, 1985, 1986, 1987), Hilty & Brown (1986), Humphrey *et al.* (1970), Jaksic & Jiménez (1986), Jiménez (1993), Johnsgard (1990), Johnson (1965), Kiff *et al.* (1980), Klimaitis & Moschione (1987), Ligon (1961), Lowery & Dalquest (1951), Mader (1981), Olrog (1979), Palmer (1988), de la Peña (1992), Pinto (1964), Ridgely & Gwynne (1989), Sherrod (1978), Sick (1985a, 1993), Snyder & Snyder (1991), Strecker (1930), Thiollay (1980b), Wetmore (1965).

44. Merlin

Falco columbarius

French: Faucon émerillon

German: Merlin

Spanish: Esmerejón

Other common names: Pigeon Hawk

Taxonomy. *Falco columbarius* Linnaeus, 1758, America = South Carolina.

Formerly placed in genus *Aesalon*. Has been allied with *F. chicquera*, but no clear relationship. Nine subspecies normally recognized.

Subspecies and Distribution.

F. c. subaeson C. L. Brehm, 1827 - Iceland.

F. c. aesalon Tunstall, 1771 - N Eurasia, from Faeroes E to C Siberia.

F. c. insignis (Clark, 1907) - Siberia, E of R Yenisey to R Kolyma.

F. c. pacificus (Stegmann, 1929) - Soviet Far E, including Sakhalin I.

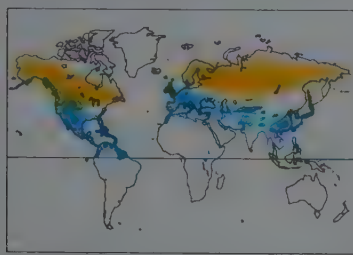
F. c. pallidus (Sushkin, 1900) - steppes of Asia, from near Aral Sea to Altai Mts.

F. c. lymani Bangs, 1913 - mountains of C Asia, in Turkestan, E Russia, NW China and Mongolia.

F. c. suckleyi Ridgway, 1873 - Pacific coast of North America, from Alaska and British Columbia to N Washington.

F. c. columbarius Linnaeus, 1758 - North America, except Pacific coast and Great Plains.

F. c. richardsoni Ridgway, 1871 - Great Plains of North America, from C Alberta S to Wyoming.



Descriptive notes. 24-33 cm; male 150-210 g, female 189-255 g; wingspan 50-67 cm. Distinctive small, stocky, dashing falcon. Male has upperparts dark or pale bluish, underparts from dark and heavily streaked to pale buff and lightly streaked; usually conspicuous pale bands in tail. Female browner, without blue tones; plumage generally more uniform, less contrasted than in male. Juvenile similar to female. Races differ in overall plumage tone, with upperparts of male deep blackish blue in forested or moist regions, but pale greyish blue in arid steppe regions; *suckleyi* darkest, *pallidus* palest; also some difference in size.

Habitat. Extremely varied, from sea-level up to tree-line in some mountain ranges, from boreal forest and tundra to parkland with deciduous trees, shrub-steppe, moorland, open prairies and steppes. Some trees or scrubby vegetation generally preferred. Occurs in even broader range of habitats on migration, often along sea coasts.

Food and Feeding. Chiefly small birds under 50 g during breeding season; larger birds (e.g. sandpipers), bats and insects (e.g. dragonflies, locusts) after breeding and during migration; small rodents and shrews also caught, especially by young birds in first year. Usually attacks from perch, but also while flying low over ground. Prey mainly caught in mid-air; attacks less frequently directed at perched birds; often performs hot pursuit of prey in flight. Sometimes hunts in company of other raptors, e.g. Sharp-shinned Hawk (*Accipiter striatus*), and pairs hunt co-operatively, e.g. in up to 30% of hunting attempts in Iceland. Prey flushed by other raptors and other objects (e.g. automobiles, trains) is also caught. Success rates of 5-40%, depending somewhat on terrain, prey type and time of year. Food may be cached for later consumption.

Breeding. Mar-June. Solitary. Presence of nest helpers (usually yearling males) and extra-pair copulation both recorded. No nest built; heavy use of old stick nests of other species especially corvids (*Corvus*, *Pica*) in trees; also uses tree cavities, cliff ledges or stick nests on ledges; also on ground, usually in scrape made in thick vegetation cover; frequency of given nest type somewhat

dependant on region, e.g. 74% on ground in Britain, cliffs used in Iceland, but mainly trees in S Canada and forested parts of Norway; locally breeds at urban sites, e.g. in Canada. Usually 3-6 eggs; incubation 28-32 days, by both sexes, with males performing 7-15%: chicks have buffy brownish down on upperparts, grading to white underparts; fledging 28-32 days. Nest success c. 60-90% of eggs laid; fledging c. 68-80%; locally, in Norway, high success related to good vole (*Microtus*) years, with 76% fledging in good years, 38% in bad years. Breeds first at 1 year. Oldest ringed bird 10 years 7 months.

Movements. Migratory, except for populations in Iceland, British Is, locally in C Asian mountains, Pacific NW in North America, and locally in Canadian prairies. Generally moves wholly S of breeding range, with southernmost breeding populations tending to migrate shortest distances. In Eurasia moves S to Mediterranean, N Africa, Arabian Gulf, Iraq, Iran, China, Japan and Korea; in North America moves S to Venezuela, Ecuador and N Peru, and recorded S to Manaus (NC Brazil) and French Guiana; many offshore sightings, with stragglers moving across oceans as far as Philippines and Hawaii. Peak autumn migration late Aug to late Sept; peak spring migration from mid-Mar to mid-Apr.

Status and Conservation. Not globally threatened. CITES II. Status of Asian races not satisfactorily documented. Between 1960 and 1970's, significant accumulations of chlorinated hydrocarbons caused some reproductive failure; eggshells showed 13% thinning in Europe, and 23% in North America, with maximum record of 30% in Canadian prairies. Populations in Canada and Europe declined during that period; data insufficient to determine effects on Asian populations over same period. Currently (1993) chemical residues are not significant; eggshells are returning to normal thickness, and European and North American populations increasing, as indicated by breeding densities and distributions, migration counts and wintering distributions and numbers. At same time, at least in North America, alterations are reducing availability of suitable habitat; some habitat loss offset by habituation of species to humans and altered landscapes, and adaptation to urban nesting. Collision with man-made objects accounted for 43% of mortality of 88 birds in Canada. No comprehensive population estimates, but in 1980's estimated at: a few 10,000's of pairs for Eurasia, e.g. over 800 in UK, 2000 in Sweden, 1600 Finland, and 1600 in Estonia; and several thousand pairs in North America, e.g. minimum 2000 in Saskatchewan. Estimates for 1993 include 250-300 pairs in Byelorussia and possibly as many as 30,000 pairs in European Russia; by 1993 populations in UK had increased to estimated 1300 pairs.

Bibliography. Ali & Ripley (1978), Becker & Sieg (1985), Bengston (1975), Blake (1977), Brazil (1991), Brown *et al.* (1982), Buchanan (1988), Buchanan *et al.* (1988), Carlsen (1992), Clark (1985), Connette (1990), Cramp & Simmons (1980), Dekker, D. (1988), Dementiev & Gladkov (1951), Dickson (1991, 1988), Enderson *et al.* (1991), Etchecopar & Hie (1978), Fjeldså & Krabbe (1990), Flint *et al.* (1984), Fox (1971), Genshel (1986), Glutz von Blotzheim *et al.* (1971), Goodman *et al.* (1989), Hanas & Zusi (1992), Handrinos & Demetropoulos (1983), Hård & Enemar (1980), Hilty & Brown (1986), Hodson (1976), James & Oliphant (1986), James *et al.* (1987), Johnsgard (1990), Kjellen (1992), Laing (1985), Mackworth-Præd & Grant (1962), Meek (1988), Newton & Haas (1988), Nielsen (1986), Noble & Elliot (1990), Oliphant (1985), Oliphant & Haug (1985), Palmer (1988), Parr (1991), Paz (1987), Roberts (1991), Rodriguez-Duran & Lewis (1985), Rogacheva (1992), Sick (1985a, 1993), Sieg & Becker (1990), Simeonov *et al.* (1990), Slud (1964), Snyder & Wiley (1976), Sodhi (1991a, 1991b), Sodhi *et al.* (1991, 1993), Stirling (1993), Sunyer & Viñuela (1991), Swem *et al.* (1992), Temple (1972a, 1972b), Thompson *et al.* (1989), Titus & Fuller (1990), Warkentin & Oliphant (1985), Warkentin *et al.* (1992), Wetmore (1965), White (1994), Wiklund (1982), Williams, G.A. (1981).

45. Bat Falcon

Falco rufigularis

French: Faucon des chauves-souris German: Fledermausfalke Spanish: Halcón Murcielaguero

Taxonomy. *Falco rufigularis* Daudin, 1800, Cayenne.

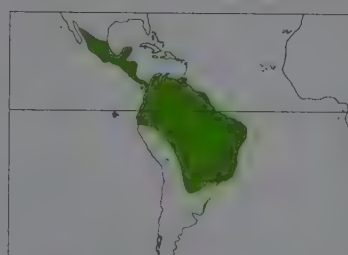
May belong in *F. subbuteo* complex. Similarity to *F. deiroleucus* probably reflects a recent common ancestor rather than convergence. In past, alternatively labelled *F. albicularis*. Validity of race *ophryophanes* sometimes challenged. Northernmost populations sometimes awarded separate race, *petrophilus*. Three subspecies recognized.

Subspecies and Distribution.

F. r. petraensis Chubb, 1918 - N Mexico (from Sonora E to Tamaulipas) S through Central America to Colombia, and W of Andes S to Ecuador.

F. r. rufigularis Daudin, 1800 - E Colombia E to the Guianas and Trinidad, and S to S Brazil and N Argentina.

F. r. ophryophanes (Salvadori, 1895) - tableland of C Brazil (Piauí S to Mato Grosso, São Paulo and Paraná) and adjacent Bolivia, Paraguay and N Argentina.



Descriptive notes. 24-29 cm; male 108-148 g, wingspan 56-58 cm; female 177-242 g, wingspan 65-67 cm. Small version of *F. deiroleucus*, with broader black breast band more finely barred; lacks pale nape of larger *F. f. femoralis*. Head and upperparts black, with greyish edging to contour feathers from upper back to tail-coverts; throat and upper breast white, buff or cinnamon, extending to hind neck; rest of breast and underwings black, finely barred white; belly, thighs and under-tail-coverts chestnut rufous; rather long tail blackish, with several fine white or greyish bars and white or buff tip. Iris deep brown,

cere and legs bright yellow. Female much larger. Immature uniform black above; throat more buff-coloured; tawny tinge to barring on breast; undertail-coverts with black bars or spots. Races distinguished by tone of plumage coloration.

Habitat. Tropical forests, from lowlands up to montane forest at 1600 m. Fairly adaptable; inhabits unbroken forest, where hunts over canopy; sometimes reported to be more common in more broken forest (disturbed areas, forest edge, road cuts, riverbanks or cleared agricultural land with scattered trees), but this apparent predilection may be result of species being more conspicuous in such areas; observations at one nest suggest preference for foraging over intact forest rather than cleared areas.

Food and Feeding. Mainly bats, birds and large insects. Percentage of birds to bats in diet varies greatly between areas. Wide variety of birds, with 56 species caught by 1 pair in Venezuela: mostly highly aerial species, e.g. swifts, swallows and hummingbirds. Insects include dragonflies (Odonata), moths (Lepidoptera), large grasshoppers (Orthoptera), Homoptera and Hymenoptera. Mostly hunts around dawn and dusk, often well after sunset. Prey almost always taken in air, but some rats and geckos caught on ground. From high perch, will attack birds moving above canopy, through open areas, or even across road cuts through forest; more rarely hunts from high in air, chasing high-flying insects or stooping at prey below. Flies low over canopy trying to flush prey from canopy; one seen flying to canopy tree, clinging to branch while flapping wings for several seconds.

and then flying up to catch insects flushed from tree. In French Guiana, males and females employ different techniques for catching bats.

Breeding. Most data from E Mexico, with only handful of nesting attempts observed elsewhere. Season seems protracted: in Guatemala (Petén), Belize and Mexico, courtship begins in Feb-Mar (middle of dry season); in Trinidad, nesting in Feb; in Colombia, birds in breeding condition in Feb-Mar; eggs in Mar in N Venezuela, in Apr in Guyana, and in Aug (middle of dry season) in NC Brazil (Mannus). Nests in natural tree cavities or holes excavated by parrots, in old trogon nests in termite colonies, or on cliffs; also on pre-Columbian ruins, and more modern man-made structures, e.g. on sugar mill crane, in Guyana. Copulation often preceded by courtship feeding; both parents vocal and aggressive around nest tree, chasing other raptors flying as far off as 1 km from nest tree. 2-4 eggs (average 2.9, in Mexico); fledging c. 35-40 days. Male provides virtually all of food during nestling phase.

Movements. Apparently sedentary.

Status and Conservation. Not globally threatened. CITES II. Widespread and generally not uncommon in appropriate habitat. Tolerates, and may even benefit from, patchy, small-scale deforestation (although this is uncertain). However, in Central America no longer breeds in several areas where forest extensively transformed to agriculture; this trend likely to be repeated elsewhere throughout range.

Bibliography. Beebe (1950), Blake (1977), Cade (1982), Chavez-Ramírez & Contreras *et al.* (1990), Enkerlin (1991), French (1973, 1992), Haverschmidt (1962), Hilty & Brown (1986), Inigo-Elias (1993), Kiff *et al.* (1980), Kirven (1976), Monroe (1968), Parker (1991b, 1993), de la Peña (1992), Pinto (1964), Ridgely & Gwynne (1989), Ruschi (1979), Russell (1964), Schaldach (1963), Schulenberg & Parker (1981), Sick (1985a, 1993), Slud (1964), Siles & Skutch (1989), Teixeira *et al.* (1987a), Terborgh & Weske (1975), Tostain (1986a), Voous (1969), Wetmore (1965).

46. Orange-breasted Falcon

Falco deiroleucus

French: Faucon orangé

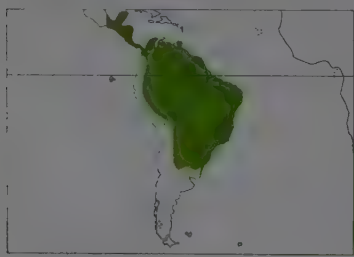
German: Rotbrustfalke

Spanish: Halcón Pechirrojo

Taxonomy. *Falco deiroleucus* Temminck, 1825, São Francisco Island, Santa Catarina, Brazil.

Vocalizations most unusual among falcons, shared only with *F. ruficularis*, to which probably closely related; sometimes associated with *F. peregrinus* complex, but now appears clearly related to "hobbies". Monotypic.

Distribution. S Mexico S through Central America to Colombia, E to the Guianas and Trinidad, and E of Andes S through Brazil and Bolivia to Paraguay and N Argentina. Formerly thought to nest only around periphery of Amazon, but recent records of adults and juveniles in C Brazilian Amazonia suggest that species breeds throughout extensive range.



Descriptive notes. 33-40 cm; female 654 g. Toes abnormally long and mandible disproportionately large for a falcon; bright yellow feet so large as to be useful characteristic for field identification. Differs from smaller *F. ruficularis* in coarser barring on narrower breast band, and much larger feet. Very dark above, with black "helmet"; throat white, breast rufous orange; black breast band coarsely barred rufous; thighs and vent rufous orange. Female much larger; largest females weigh twice as much as smallest males. Immatures have two distinct plumages: all show dark "cummerbund" across mid-breast, barred white; in others orange with little or no white; some

birds have upper breast and throat mainly white, in others orange with little or no white; some birds have barring on thighs and undertail-coverts.

Habitat. Locally throughout lowland tropical forest, but also reported at interface of forest and open savanna; inhabits drier regions (Chaco) with gallery forest along streams and cliffs at S limit of range. E Andean slopes in subtropical forest, up to 1100 m in Cochabamba (SC Bolivia). Appears to be ecological replacement of *F. peregrinus* throughout most of Neotropics. Often seen on knoll, cliff or ridge overlooking vast expanses of unbroken rain forest or Chaco.

Food and Feeding. Highly specialized on flying prey, including pigeons, conures, parrots, swifts and martins flying above forest; bats also important, captured well after sunset and well before dawn. Enormous feet enable species to grasp large birds of canopy. Very few observations of hunting behaviour, but most attempts involve long, low flight initiated from high perch; will set off on long flight to intercept moving flocks of swifts, with sudden swing upwards into the flock. Rarely stoops from far above prey in manner of *F. peregrinus*. Adults and young cache food in epiphytes.

Breeding. Almost all available data from Ecuador, or Guatemala and Belize. In Guatemala and Belize, courtship in Feb, fledging in May-Jun (end of dry season). Nests in trees or cliffs, often near water; also in pre-Columbian ruins. Males deliver as many as 3 prey items per day when courting; copulation often preceded by courtship feeding. Clutch small, probably 1-3 eggs; incubation c. 30 days; fledging c. 40 days. Incubation and feeding of young mainly by female. Male rarely enters nest; calls female off nest for food transfer; if female does not respond, male caches prey, rather than delivering it to young in nest.

Movements. Apparently sedentary.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Sparse distribution throughout range and apparent sensitivity to deforestation suggest species requires careful attention. Generally rare, but may be more abundant locally than normally believed; in 1992, total of 10 pairs known in Belize and in and around Tikal National Park (Guatemala); in two different cases, 3 pairs nested within radius of 10 km. May be displaced from potential nest-sites by American Black Vultures (*Coragyps atratus*), which arrive in association with human occupation and deforestation; traditional nest at Tikal monuments in the Petén (Guatemala) now occupied by vultures; another traditional nest on nearby cliff no longer occupied by present species, but supports large number of vultures. Virtually all information available on breeding biology of species comes from long-term study in Ecuador and Peregrine Fund's Maya Project in Guatemala and Belize. Peregrine Fund has established captive breeding programme with small number of birds. Population of Guatemala and Belize possibly disjunct now from South American populations, and may merit special concern.

Bibliography. Baker *et al.* (1992), Baker & Whitmore (1993), Blake (1977), Boyce (1980), Boyce & Kiff (1981), Cabot & Serrano (1986), Collar & Andrew (1988), Contreras *et al.* (1990), Field & Krabbe (1990), Freemann (1950), Giescom (1932), Hardy *et al.* (1975), Haverschmidt (1968, 1980), Herman & Hedsorn (1990), Hilty & Brown (1986), Howell (1992), Jenny (1989), Jenny & Cade (1986), Jenny & Barnham (1987), Kiff (1988), Land (1970), Meyburg (1986), Monroe (1968), Ofreg (1985), de la Peña (1992), Pinto (1964), Remsen & Ridgely (1980), Ridgely & Gwynne (1989), Remsen & Hedges (1984), Short (1975), Sick (1985a, 1993), Slud (1964), Smith (1966), Smith & Paynter (1963), Stiles & Skutch (1989), Thiollay (1989a), Weick (1989), Wetmore (1965), Whitacre & Jenny (1991).

47. Eurasian Hobby

Falco subbuteo

French: Faucon hobereau

German: Baumfalke

Spanish: Alcotán Europeo

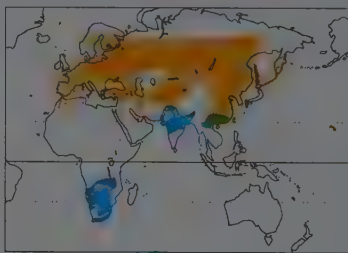
Taxonomy. *Falco Subbuteo* Linnaeus, 1758, Sweden.

Forms superspecies with *F. cuvierii*, and possibly also *F. severus* and *F. longipennis*; sometimes considered conspecific with *F. cuvierii*. Two subspecies recognized.

Subspecies and Distribution.

F. s. subbuteo Linnaeus, 1758 - NW Africa and Europe E through C Asia and N China to Kamchatka, Sakhalin and N Japan; winters in C & S Africa and S Asia.

F. s. streichi Hartert & Neumann, 1907 - S & E China, S from Qin Ling Mts (S Shaanxi); possibly also N & E Burma and N Indochina.



Descriptive notes. 28-36 cm; male 131-232 g, female 141-340 g; wingspan 69-84 cm. Red thighs and undertail-coverts; pale throat and cheeks contrast with densely streaked whitish or buff underparts. Female slightly larger. Juvenile browner and with pale feather edges above; buff undertail-coverts and thighs, pale crown.

Habitat. Open wooded areas: wooded steppe, pastures, cultivation or scrub with clumps of trees, scattered trees or copses; fields with hedges, edges of woods, etc. From semi-arid areas to boreal forests. Mainly at low altitudes in plains or foothills, but also in mountains,

up to 4000 m in India. Occasionally in cities or suburbs. In winter, occurs in woodland, especially *Brachystegia*, and savanna.

Food and Feeding. Mainly insects, especially flying insects which are eaten on the wing, e.g. dragonflies, beetles, moths, grasshoppers, locusts, crickets, ants. Also many small birds, especially in breeding season, when takes advantage of abundance of fledglings; birds include swallows, martins and swifts, as well as less aerial species of open areas, e.g. sparrows, finches, starlings, larks and pipits. Few other vertebrates, although bats and lizards locally important; some individuals specialize in certain prey type. In winter quarters in Africa, takes flying insects, particularly swarming alate termites, and also birds. Captures prey mainly in air; able to catch very agile birds due to fast, acrobatic flight; very active at dawn and dusk; visits colonies or roosts of prey species, sometimes in cities and their suburbs; follows fires or farm vehicles which flush prey.

Breeding. Lays late, mainly in Jun-Jul; late May in some areas. Solitary; uses unoccupied nests of corvids (e.g. crows, magpies) or other raptors; almost always in trees, preferring pines, but also in other conifers and broad-leaved trees; exceptionally on cliffs. Nest-site may be reused each year, not necessarily by same pair. Normally 3 eggs (2-4), laid at interval of 2-3 days; replacement laying occurs; incubation 28-33 days, mainly by female; chicks have pale creamy buff first down, greyer second down; fledging 28-34 days; juveniles dependent on adults c. 5 weeks more. Fledging success in Germany, 1-4 chicks per breeding pair, 2-4 chicks per successful pair; can be much lower. Sexual maturity normally at 2 years, sometimes 1. Oldest recorded bird 10 years old.

Movements. Mostly migratory, but *streichi* sedentary; wintering generally rare in Palearctic, e.g. small numbers in S Japan. Mainly winters in Africa, with bulk of numbers in S third of continent, arriving mainly in Nov; E birds in S & SE Asia, especially Indian Subcontinent; also in S China, alongside resident population; recorded S to Java and Timor. Normally returns to breeding areas in late Apr and May, mostly leaving in Aug-Sept. Migrates on broad fronts.

Status and Conservation. Not globally threatened. CITES II. Population levels and trends not well known; local fluctuations can be considerable, but overall possibly stable in long term; no recent declines noted in winter quarters. Difficult to estimate numbers accurately; in 1980's, European population (excluding former USSR) possibly 11,000-14,000 pairs, but perhaps up to 20,000; preliminary estimate for European Russia of 70,000 pairs in early 1990's; 1100-1600 pairs in Byelorussia; 150-200 pairs in Azerbaijan; still fairly common in Ukraine, but declining due to cutting down of old forest patches. Estimates of 500-1000 pairs in Morocco and in Turkey in 1980's. Little information available for Asia, although Asian population of former USSR may be less dense than European.

Bibliography. Ali & Ripley (1978), Bergier (1987), Bijlsma (1980), Brazil (1991), Brazil & Hanawa (1991), Brown *et al.* (1982), Burton & Boyer (1989), Chancellor (1991), Cheng Tso-hin (1987), Cramp & Simmons (1980), Dementiev & Gladkov (1951), Etchecopar & Hùe (1978), Fluczynski (1978, 1987, 1991), Fluczynski & Netherlands-Thompson (1980), Flint *et al.* (1984), Gónsøl (1986), Ginn *et al.* (1989), Goodman *et al.* (1989), Handrinos & Demetropoulos (1983), Hou *et al.* (1990), Kemp & Crowe (1993), Kjellen (1992), Knystautas (1993), Lúis (1961), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Marchant *et al.* (1990), Martin, B.P. (1992), Palmer (1988), Parr (1985), Patrikeev (1993), Paz (1987), Pepler (1991, 1993), Pickford *et al.* (1989), Pinto (1983), Richardson (1990), Roberts (1991), Rogacheva (1992), Shirihai & Christie (1992), Schuyt *et al.* (1936), Simeonov *et al.* (1990), Thiollay (1989c).

48. African Hobby

Falco cuvierii

French: Faucon de Cuvier

German: Afrikanischer Baumfalke

Spanish: Alcotán Africano

Taxonomy. *Falco Cuvierii* A. Smith, 1830, South Africa.

Forms superspecies with *F. subbuteo* and possibly also *F. severus* and *F. longipennis*; sometimes considered conspecific with *F. subbuteo*. Monotypic.

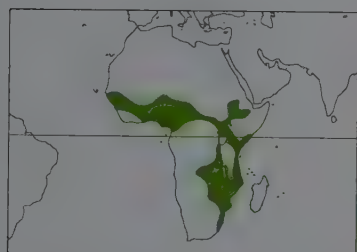
Distribution. Senegambia E to Ethiopia and S to SE South Africa.

Descriptive notes. 28-30 cm; male 125-178 g, female 186-224 g. Small dark falcon with long, slender wings and rich chestnut underparts. Juvenile has underparts more heavily streaked and upperparts edged with brown. Migrant long-winged *F. subbuteo* has chestnut restricted to thighs and undertail-coverts; similarly built juvenile *F. concolor* lacks chestnut tones on underparts, while adult grey all over.

Habitat. Moist woodland and tree savanna, including palm savanna and forest edge, up to over 2500 m.

Food and feeding. Outside breeding season, mainly insects, especially termite alates; when breeding, mainly small birds, up to the size of doves. Most prey taken high in the air using fast and dextrous flight, with high success (95% for insects, 72% for birds); up to 30 individuals gathering at insect emergences. Roosts in tall trees and spends much of the day at rest there. Hunts mainly at dawn and dusk.

Breeding. Laying Dec-Apr in W and NE Africa; Aug-Nov in SE and S Africa. Nests in tall trees, at height of up to 30 m, in old structure of crow or other raptor, or in epiphyte. Often evicts owners, and very defensive of nest area. Usually 3 eggs (2-4); incubation c. 30 days; chicks have first down cream.



second down grey; fledging c. 30 days. Male feeds female during incubation or caches food near nest; later, female catches some insects herself in vicinity of nest.

Movements. Resident as pairs in many areas, but may be locally migratory in parts of W Africa. A wet season vagrant, sometimes breeding, to the periphery of its range in NE Kenya and S Africa. No details of movements available.

Status and Conservation. Not globally threatened. CITES II. Widespread, but generally uncommon to rare; common along forest-savanna ecotone in parts of W Africa and L

Victoria basin of E Africa. Common in several densely populated areas, even within cities. Territory of 160-200 ha, hunting range over 600 ha. Not known to be affected by pesticide use.

Bibliography. Brooke & Howells (1971), Brown *et al.* (1982), Cade (1982), Forbes-Watson (1963), Ginn *et al.* (1989), Gore (1990), Irwin (1981), Lewis & Pomeroy (1989), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Pakenham (1979), Pickford *et al.* (1989), Pinto (1983), Pitman (1966), Steyn (1965b, 1982), Thiollay (1975a, 1976b, 1977c, 1978c).

49. Oriental Hobby

Falco severus

French: Faucon aldovandin **German:** Maleienbaumfalke

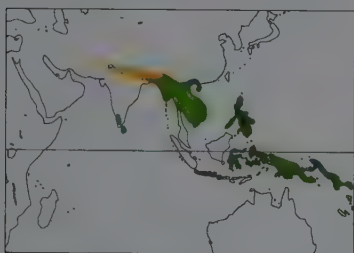
Spanish: Alcotán Filipino

Other common names: Indian Hobby

Taxonomy. *Falco severus* Horsfield, 1821, Java.

Forms superspecies with *F. longipennis*, and perhaps also with *F. subbuteo* and *F. cuvierii*. Variation of present species in size and plumage slight and clinal; insufficient for racial differentiation. Monotypic.

Distribution. NW India and Nepal E to Yunnan, Guangdong and Hainan (S China), and S through Burma, Thailand and Indochina to Philippines, Java and Sulawesi, whence E through New Guinea to Solomon Is. Himalayan birds winter S to S India and Sri Lanka.



Descriptive notes. 24-30 cm; 168-249 g; wingspan 66 cm. Small, short-tailed, black and rufous falcon; solid rufous underparts separate from other hobbies. Juvenile similar, but heavily streaked on rufous underparts. Clinal variation in plumage tone, from paler birds in W to darker ones in E.

Habitat. Forest with clearings, from mangroves at sea-level to deciduous and evergreen forest in foothills and mountains up to 2500 m; also seen hunting over scrub.

Food and Feeding. Insects, small birds and bats. Hunts from exposed perch on tall tree; when sights prey, launches direct, rapid,

strong flight to capture prey in the air; captured prey taken back to perch where eaten. Also hawks dragonflies over water. Hunts most often at dawn and dusk. Often gathers in loose flocks; joins flocks of wood-swallows (*Artamus*) hawking insects.

Breeding. Season varies regionally: Apr-Jul in India and Burma; Jun in Java; Mar in Philippines. Stick nest in tree, usually on slope; uses nests constructed by other birds, mostly other raptors or corvids. Display flights involve series of undulations, with shallow, rapid, fluttering wingbeats on upsweeps, and gliding descent, accompanied by vocalizations. Usually 3-4 eggs; incubation 28-30 days, by both sexes; fledging 30+ days. Period of chick dependency unrecorded.

Movements. Populations of Himalayas migratory, moving S for winter; others apparently sedentary. Vagrant to Borneo and probably to Malay Peninsula.

Status and Conservation. Not globally threatened. CITES II. Generally rare and local; in Philippines, uncommon but regularly recorded. No threats known at present; surveys required over much of range, in order to clarify status. Alleged occurrence in Pakistan has been challenged; status in Sumatra uncertain, with no definite records; recently recorded on Seram.

Bibliography. Ali & Ripley (1978), Beehler *et al.* (1986), Bishop *et al.* (1994), Bowler & Taylor (1989), Cade (1982), Coates (1985), Cheng Tso-hin (1987), Deignan (1945), Diamond (1972), Dickinson *et al.* (1991), DuPont & Rabor (1973), Hadden (1981), Inskipp & Inskipp (1985), King *et al.* (1975), Lekagul & Round (1991), MacKinnon (1988), MacKinnon & Phillips (1993), van Marle & Voous (1988), Medway & Wells (1976), Meyer de Schauensee (1984), Rand & Rabor (1960), Roberts (1991), Smythies (1981, 1986), Sresemann (1940a), White & Bruce (1986).

50. Australian Hobby

Falco longipennis

French: Petit Faucon

German: Australischer Baumfalke

Spanish: Alcotán Australiano

Other common names: Little Falcon

Taxonomy. *Falco longipennis* Swainson, 1837, Tasmania.

Forms superspecies with *F. severus*, and perhaps also with *F. subbuteo* and *F. cuvierii*. Pale race *marchisonianus* of inland and N Australia commonly recognized, but probably invalid because intergradation occurs with dark birds of S humid areas. Population on Lesser Sunda Is apparently a distinct race, although very limited information available. Two subspecies recognized.

Subspecies and Distribution.

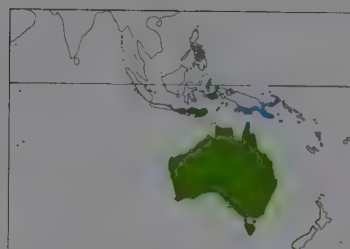
F. l. hanieli Hellmayr, 1914 - Lesser Sundas, from Lombok to Timor.

F. l. longipennis Swainson, 1837 - Australia and Tasmania; outside breeding season occurs N to New Guinea, New Britain and Moluccas.

Descriptive notes. 30-35 cm; male 132-280 g, larger female 190-365 g; wingspan 66-87 cm. Small *Falco*, resembling other hobbies. Distinguished from *F. peregrinus* by smaller size, slighter build, longer and narrower wings and tail. Juvenile has upperparts tinged brown, richer rufous underparts. Regional variation in colour within Australia; race *hanieli* slightly smaller and paler below.

Habitat. Open forest, woodland, savanna and adjacent treeless habitats, wooded farmland and urban areas with plenty of trees; from sea-level to 2000 m. Nests in trees.

Food and Feeding. Small birds, small insectivorous bats and flying insects. Mostly terrestrial flocking birds, such as larks, pipits, grassfinches (Ploceidae), doves and small parrots; also aerial birds, such as swallows. Commonly takes introduced sparrows (*Passer*) and starlings (*Stumus*) in



farmland and towns. Most prey of under 100 g, rarely over 200 g. Diurnal, crepuscular and sometimes nocturnal, using artificial light. Forages by low, fast flight, still-hunting on prominent perch, or high quartering. Seizes prey in flight by shallow stoop or direct flying attack that may become vigorous chase; hawks flying insects; occasionally steals mice from *F. cenchroides*.

Breeding. Aug-Jan. Solitary. Uses old or usurped large stick nest of other species, typically *Corvus*, high (over 10 m) above ground, in top of tree or electricity pylon. Usually 2-3 eggs (2-4); incubation c. 28-35 days; chicks post-fledging dependence of up to 6 weeks.

have cream-coloured down; fledging 34-38 days; Success 2-75 young per year, for a pair over 4 years; successful broods commonly of 2-3 young. Oldest ringed bird 7 years.

Movements. Resident and partly migratory populations. Birds breeding at high latitudes and altitudes winter in coastal and lowland areas; many migrate N, some (mostly females) reaching New Guinea, New Britain and E Indonesia.

Status and Conservation. Not globally threatened. CITES II. Fairly common and widespread, even in cities and towns. Population probably stable; has benefited from introduced prey. Eggshell thickness significantly reduced by DDT use (now ceased); local breeding depression likely in S agricultural areas. Seldom shot.

Bibliography. Beehler *et al.* (1986), Coates (1985), Copper & Copper (1981), Czechura & Czechura (1988), Czechura & Debus (1986), Debus *et al.* (1991), Hollands (1984), Marchant & Higgins (1993), Metcalf (1989), Newgrain *et al.* (1993a), Olsen & Marples (1993), Olsen & Olsen (1980a, 1987a), Olsen, Crome & Olsen (1993), Olsen, Fuller & Marples (1993), Schodde & Tidemann (1988), Tarburton (1991), Veerman (1991), White & Bruce (1986).

51. New Zealand Falcon

Falco novaeseelandiae

French: Faucon de Nouvelle-Zélande

German: Maorifalke

Spanish: Halcón Maorí

Other common names: New Zealand Hobby

Taxonomy. *Falco novae-Seelandiae* Gmelin, 1788, Queen Charlotte Sound, New Zealand.

Has been placed in separate genus, *Nesierax*, or in *Hieracidea* with *F. berigora*, to which most closely related, but also related to other Australasian and Gondwanan hobbies. Two forms, *no-vaeseelandiae* and *pottsii*, previously regarded as races or separate species on size and plumage differences, but confusion with age and sex differences. Three morphologically and ecologically distinct populations, with separate distributions, not formally recognized as races. Monotypic.

Distribution. New Zealand, Stewart I, Auckland Is.



Descriptive notes. 41-48 cm; male 252-500 g, larger female 420-594 g; wingspan 66-91 cm. Medium-sized *Falco*, distinctively short-winged for genus. Unmistakable in New Zealand, where is only dark *Falco*. Juvenile has more uniform upperparts, darker and less heavily marked underparts. "Bush form" in forest on North I and NW of South I, small and dark; "eastern form" of open habitats on South I, large and pale; "southern form" in forest on Stewart I and Auckland Is and SW coast of South I, intermediate, but closer to "bush form".

Habitat. Forest and adjacent grassland, typically in mosaic of forest remnants and cleared rangeland in hills and mountains; from sea-level to 2100 m. Nests in forest, cliffs and steep broken hillsides remote from humans.

Food and Feeding. Mainly birds, now mostly introduced species; sometimes small mammals, insects and lizards, rarely carrion. Commonly passerines, but mammals and birds ranging up to size of young rabbits and hares, stoats, herons and waterfowl. Forages by low, fast flight, quartering and high soaring, or still-hunting from perch. Seizes or strikes prey in flight by stoop or direct flying attack, which may become vigorous chase; takes prey on ground by glide from perch. Also flushes prey from cover, stalks on ground, robs nests; pairs hunt co-operatively.

Breeding. Sept-Nov, sometimes Dec. Solitary. Nest is simple scrape or depression in grassy soil of cliff face or steep hillside, or in humus of epiphyte growing on tree; rarely in tree hollow; sites on ground protected by rock overhang, vegetation or log. 2-4 eggs; incubation 29-35 days; chicks have white first down, grey second down; fledging c. 32-35 days; post-fledging dependence 70-90 days. Success 1-9 young fledged per attempt, 2-6 per successful nest; higher at cliff sites than at ground sites. Sexual maturity at 2 years; unsuccessful breeding attempts sometimes at 1 year.

Movements. Adult pairs sedentary; juveniles dispersive, sometimes moving N or to lowlands.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Population declined through habitat destruction, persecution and effects of DDT, but now stable at c. 3000-4500 breeding pairs. Uncommon and generally confined to rough and remote areas, but has benefited from fragmentation of dense forest and establishment of introduced birds and mammals.

Bibliography. Chambers (1989), Falla *et al.* (1981), Fox (1977a, 1977b, 1977c, 1978, 1979, 1985, 1988), Hedley & Hedley (1982), Lawrence & Gay (1991), Marchant & Higgins (1993), Read (1985), Soper (1976), Taylor (1977)

52. Brown Falcon

Falco berigora

French: Faucon berigora

German: Habichtfalke

Spanish: Halcón Berigora

Taxonomy. *Falco Berigora* Vigors and Horsfield, 1827, New South Wales.

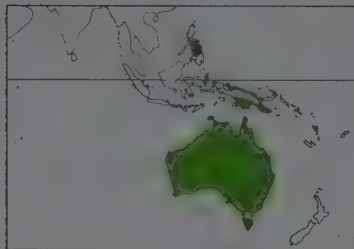
Has been separated in genus *Ieracidea* or *Hieracidea*, but a typical *Falco* in most respects and closely related to *F. novaeseelandiae*. Up to seven races described, but much confusion owing to complexity of colour morphs, and recent studies suggest that most are invalid. Three subspecies now recognized.

Subspecies and Distribution.

F. b. novaeguineae (A. B. Meyer, 1894) - C & E New Guinea and coastal N Australia.

F. b. berigora Vigors & Horsfield, 1827 - E. C & N Australia and Tasmania.

F. b. occidentalis (Gould, 1844) - SW & CW Australia.



Descriptive notes. 41-51 cm; male 316-590 g, larger female 430-860 g; wingspan 89-109 cm. Medium-sized *Falco*; long legs unique in genus. Extremely variable in colour, ranging from pale almost like *F. cenchroides* but with rufous thighs, to dark like *F. subniger* but with barred underwings and tail. Distinguished from *F. subniger* by long legs. Juvenile brown with buff forehead, throat and vent. Regional variation in size and colour: resident tropical race small and rufous or dark; SW birds small and rufous.

Habitat. Open woodland, savanna, grassland, farmland and deserts; from sea-level to 2000

m in Australia, rarely to 3000 m in New Guinea. Nests in trees.

Food and Feeding. Mammals, birds, reptiles (commonly snakes), amphibians, arthropods and carrion; rarely fish. Some seasonal variation in diet (see page 232). Forages mostly by still-hunting from exposed perch; also by quartering and hovering, by low fast flight or by soaring. Seizes prey on ground by glide, dive or direct flying attack that may become short chase. Pursues insects on foot; robs other raptors. Follows fires, livestock and other animals and farm machinery for flushed prey; pairs hunt co-operatively.

Breeding. Apr-Sept in N, Aug-Oct in S. Solitary. Uses old stick nest of other raptor or *Corvus* in tree; rarely on tree-fern, shrub, vines, artificial structure, cliff or termitarium; 4-30 m above ground. Usually 2-3 eggs (1-5); incubation 31-36 days; chicks have pale rufous first down, grey second down; fledging 36-42 days; post-fledging dependence 2-6 weeks. Success variously measured as 69% fledging success (of eggs laid), 1-77 young fledged per nest, and 2-39 per successful nest; 2-2 young raised per clutch laid, 2-3-2-4 per successful nest, and 1-7 young per territorial pair. Age at first breeding 3 years for males, 2 years for females. Oldest ringed bird 11 years; longevity 16 years in captivity.

Movements. Adults generally sedentary, or with local movements to winter territories. Juveniles dispersive or partly migratory within Australia; S birds winter to N, some reaching tropical Australia and New Guinea. Some irruptive movements to sites of abundant prey.

Status and Conservation. Not globally threatened. CITES II. Common and widespread; benefits from most agricultural activities, but sometimes shot or trapped. Eggshell thickness not significantly reduced by DDT in Australia.

Bibliography. Baker-Gabb (1982a, 1984a, 1984b), Beehler *et al.* (1986), Bollen (1993), Cade (1982), Coates (1985), Cupper & Cupper (1981), Czechura & Debus (1985a), Haddon (1976), Hodder (1993), Hollands (1984), Hull (1991, 1993), Klapste (1990), Marchant & Higgins (1993), Mooney (1976, 1988, 1989), Newgrain *et al.* (1993b), Olsen & Marples (1993), Olsen & Olsen (1980a), Olsen, Crome & Olsen (1993), Olsen, Ross & Olsen (1987), Reymond (1987), Schodde & Tidemann (1988), Sonter & Debus (1985), Weatherly *et al.* (1985).

53. Grey Falcon

Falco hypoleucos

French: Faucon gris

German: Silberfalke

Spanish: Halcón Gris

Taxonomy. *Falco hypoleucos* Gould, 1841, York, Western Australia. Monotypic.

Distribution. C & NW Australia.

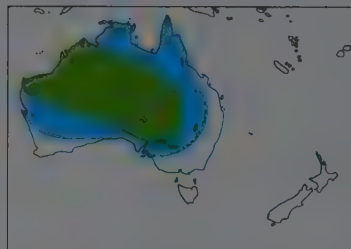
Descriptive notes. 33-43 cm; male 335 g, larger female 500-624 g; wingspan 86-97 cm. Medium-sized *Falco*. Paler than *F. peregrinus* and *F. longipennis*. Juvenile has darker upperparts, heavier streaks on underparts.

Habitat. Woodland, scrub, savanna and plains in arid and semi-arid zones; from sea-level to at least 500 m, but seldom near coast. Nests in riparian woodland in arid zone.

Food and Feeding. Birds, small mammals, lizards and large insects; mostly pigeons and parrots. Forages by low fast flight, quartering and high soaring, or still-hunting from perch. Seizes or strikes prey in flight by stoop or direct flying attack; glides from perch to take prey on ground.

Breeding. Jun-Nov. Solitary, though sometimes near raptors of other species. Uses large stick nests of other birds, typically *Corvus*, in top of emergent living tree, 9-25 m above ground. Usually 2-3 eggs (2-4); incubation c. 35 days; chicks have white down; fledging c. 41-52 days. Success of 1-9 young fledged per successful nest.

Movements. Poorly understood; resident and partly migratory or dispersive populations. Some pairs resident except during drought, when may disperse to coast or inland refugia in summer; some birds, possibly mainly juveniles, migrate to winter in N Australia.



Status and Conservation. RARE. CITES II. Scarce and possibly declining; breeding range has contracted to arid zone. Total population estimated at c. 1000 breeding pairs. Affected by habitat degradation; possibly being replaced in semi-arid agricultural zone by *F. peregrinus*, which is favoured by increase in numbers of Galah (*Cacatua roseicapilla*) and introduced feral pigeon *Columba livia*. Eggshell thickness significantly reduced by DDT use (now ceased), with local breeding decline likely to have occurred in S of range. Subject to illegal egg-collection and possibly taking of nestlings for falconry. Conservation

measures required include population survey and research into biology and ecology of species.

Bibliography. Beehler *et al.* (1986), Blakers *et al.* (1984), Cade (1982), Collar & Andrew (1988), Cupper & Cupper (1980, 1981), Czechura & Debus (1985b), Garnett (1992), Hermes (1980), Hollands (1984), Ley (1991), Marchant & Higgins (1993), Olsen & Marples (1993), Olsen & Olsen (1980a, 1986), Olsen, Crome & Olsen (1993), Olsen, Fuller & Marples (1993), Schodde & Tidemann (1988), Silveira (1988).

54. Black Falcon

Falco subniger

French: Faucon noir

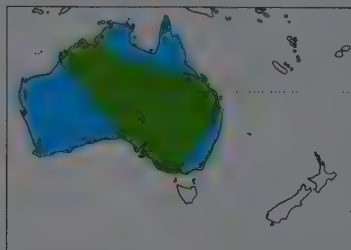
German: Rußfalke

Spanish: Halcón Negro

Taxonomy. *Falco subniger* G. R. Gray, 1843, Victoria.

Monotypic.

Distribution. C & E Australia.



Descriptive notes. 45-56 cm; male 510-710 g, larger female 610-1000 g; wingspan 97-115 cm. Medium-large *Falco*, distinctively broader-winged than most congeners. Distinguished from dark *F. berigora* by dark underwing, short legs and large feet. Juvenile similar to adult.

Habitat. Woodland, savanna, grassland and farmland; from sea-level to 1000 m, but seldom near coast. Nests in woodland and isolated trees.

Food and Feeding. Mammals, birds, large insects and carrion; rarely reptiles. Commonly young rabbits and rats; birds such as parrots,

button-quails (*Turnix*), quails, larks and pipits, rarely up to size of herons, waterfowl and smaller raptors. Forages by low, fast flight, quartering and high soaring, or still-hunting from perch. Seizes or strikes prey in flight by stoop or direct flying attack, which may become vigorous chase; hawks flying insects; glides from perch to snatch prey from ground. Sometimes hunts co-operatively in pairs. Follows grass fires, farm machinery, livestock, shooters and other raptors to seize flushed prey; robs other raptors.

Breeding. May-Nov, usually July-Sept. Solitary, though may nest near raptors of other species. Uses large stick nests of other raptors or *Corvus*, in top of living or dead tree, or rarely on electricity pylon; nests 4-14 m above ground. Usually 3-4 eggs (1-5); incubation c. 34 days; chicks have white down; fledging 38-49 days. Success 0-79 young fledged per egg laid. Oldest ringed bird 12 years.

Movements. Poorly understood. Partly migratory and dispersive; apparently some regular movement N for winter and S for summer, with irruptive occurrences related to drought or good rains in arid and semi-arid zones, local abundance of quails or plagues of other prey species.

Status and Conservation. Not globally threatened. CITES II. Generally uncommon but widespread; may be locally common in arid zone in wet years. Population fluctuates but apparently stable or may have increased in agricultural areas, where benefits from increased prey including introduced species. Eggshell thickness not significantly reduced by DDT. May be subject to limited illegal egg-collecting, and perhaps to taking of nestlings for falconry.

Bibliography. Baker-Gabb (1984a, 1989), Bedgood (1979), Cupper & Cupper (1981), Czechura & Debus (1985a), Fraser (1985), Haddon (1976), Hollands (1984), Marchant & Higgins (1993), Olsen & Marples (1993), Olsen & Olsen (1980a), Olsen, Crome & Olsen (1993), Schodde & Tidemann (1988), Whelan (1992).



55. Lanner Falcon

Falco biarmicus

French: Faucon lanier

German: Lannerfalk

Spanish: Halcón Borne

Taxonomy. *Falco biarmicus* Temminck, 1825, Cape of Good Hope.

Forms superspecies with *F. jugger*, and possibly with *F. cherrug*, *F. rusticolus* and *F. mexicanus*. Five subspecies recognized.

Subspecies and Distribution.

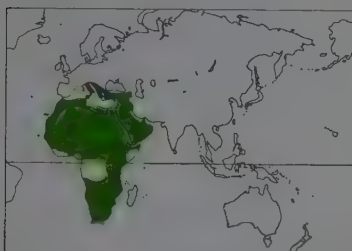
F. b. feldeggii Schlegel, 1843 - S Italy and Sicily E to Armenia and Azerbaijan, then S to Lebanon.

F. b. erlangeri Kleinschmidt, 1901 - NW Africa, from Mauritania to Morocco and Tunisia.

F. b. tanypterus Schlegel, 1843 - NE Africa, including Egypt and N Sudan, to Arabia, Israel and Iraq.

F. b. abyssinicus Neumann, 1904 - Senegal and Ghana E to Ethiopia and Somalia, and S to Uganda and N Zaire.

F. b. biarmicus Temminck, 1825 - Angola, S Zaire and Kenya S to South Africa.



Descriptive notes. 35-50 cm; male 500-600 g, female 700-900 g; wingspan 90-110 cm. Smaller *F. chicquera* has chestnut extending to neck and mantle, and underparts barred. Female larger and often darker than male. Juvenile brown above, underparts heavily streaked with dark grey; facial skin pale blue, not yellow. N races have underparts finely spotted with black, whereas almost unmarked in S populations; races also differ in size and intensity of coloration.

Habitat. Very variable, from dry, flat, open desert to wet, often forested mountains up to 5000 m. Usually with open or lightly wooded

hunting areas nearby. Overlaps with *F. peregrinus* in all but most arid areas.

Food and feeding. Mainly small birds, especially quails and columbids, augmented by rodents (*Arvicanthus* rats in Ethiopia), bats, lizards (*Uromastix* in W African deserts), insects (termite alates and locusts), and, in deserts, spiders and scorpions. Hunts mainly by fast aerial pursuit from a stoop or horizontal chase, often around a water-hole and often with a pair combining in attack; also hawks flying termites in leisurely fashion, pounces from a perch on terrestrial prey, or raids birds' nests. Catches prey. Up to 20 birds may gather at prey concentrations. Learns to use human hunters as beaters; obtains some prey by piracy; takes some carrion; often crepuscular, possibly even nocturnal.

Breeding. Rarely polyandrous. Laying Feb-May in S Europe and N Africa; Jan-Mar in Sahara, W and NE Africa, coinciding with northward passage of migrant small birds; Jun-Nov (peak Jul-Aug) in E, C and S Africa. Nests in old structures of corvids, other raptors or herons, in trees or on electricity pylons; alternatively in scrapes on cliffs, the ground, quarries or buildings. Usually 3-4 eggs (2-5), rarely double-brooded; incubation 32 days; chick with white first and second down; fledging 35-47 days. Female assists in hunting for chicks late in nestling period and during fledgling period of 1-3 months. Some interchange of, and possible competition for, nest-sites with *F. peregrinus minor*.

Movements. Resident in areas of more stable climate; local N-S migrant in W Africa; extensive movements in Africa indicated by ringing recoveries of up to 1528 km and annual surplus, especially of juveniles and non-breeding adults, in arid areas of E and SW Africa. May move into desert areas after rain, and out of forested areas during mist and heavy rain; gathers at food concentrations, e.g. breeding colonies of Red-billed Quelea (*Quelea quelea*) or emergences of locusts or termite alates.

Status and Conservation. Not globally threatened. CITES II. Widespread and generally common in Africa, even in populated areas. In Transvaal (South Africa): estimated total of 1400 pairs; nests average 9-10 km apart on farmland, or 2-5 km apart on cliffs; outnumbered *F. peregrinus* about 36:1. In Zambian savanna, mean inter-pair distance for 13 pairs was 1.8-3.5 km, and for 23 pairs on Namibian cliffs was 4 km. Apparently less common in E and W Africa. Some local declines in S Africa, possibly associated with seed dressings. In many areas of Africa benefits from bush clearance, use of grain crops by crows (providing nests) and from increased availability of prey species, including free-range poultry. Drastic decline in Europe and Israel by 1970, mainly through poisoning, falconry and shooting, e.g. formerly bred in SW Spain; however, population stable in Sicily with c. 100 pairs; 60-70 pairs in mainland Italy, and c. 100 pairs in rest of Europe, e.g. c. 30 pairs in Greece (1983). Overall effects of pesticides unknown but some high levels of contamination and local declines recorded.

Bibliography. Bergier (1987), Bijleveld (1974), Bonora & Chiavetta (1975), Brown, C.J. & Cooper (1987), Brown, L.H. *et al.* (1982), Cade (1982), Ciacco *et al.* (1987), Craib (1977, 1981), Cramp & Simmons (1980), Dalling (1975), Flint & Sorokin (1994), Flint *et al.* (1984), Gensbol (1986), Ginn *et al.* (1989), Goodman & Haynes (1989, 1992), Handrinos & Demetropoulos (1983), Juny (1960), Kemp (1972, 1975, 1993), Leonardi (1994), Leonardi *et al.* (1992), Lewis & Pomeroy (1989), Liversidge (1984), Mackworth-Praed & Grant (1962), Maclean (1993), Manzi & Perna (1994), Massa *et al.* (1991), McGowan & Massa (1990), Mendelsohn (1988b), Osborne & Colebrook-Robjent (1984), Pakenham (1979), Patincev (1993), Paz (1987), Simeonov *et al.* (1990), Sinclair & Walters (1976), Smeenk (1974), Sley (1982), Tarboton & Allan (1984), Tarboton *et al.* (1987), Yosef (1991), van Zyl (1991).

56. Laggar Falcon

Falco jugger

French: Faucon laggar

German: Laggarfalk

Spanish: Halcón Yággar

Taxonomy. *Falco jugger* J. E. Gray, 1834, India.

Sometimes considered race of *F. biarmicus*, with which forms superspecies, possibly along with *F. cherrug*, *F. rusticolus* and perhaps even *F. mexicanus*. Monotypic.

Distribution. Pakistan E throughout most of India and Nepal to Assam and N Burma; absent from extreme S India. Also occurs locally in S Afghanistan and possibly SE Iran.

Descriptive notes. 38-46 cm; 525-850 g; wingspan 95-115 cm. Large, slender falcon with long, narrow dark moustachial streak, similar to *F. biarmicus* in plumage and behaviour, but usually somewhat darker and browner, greyish brown above, white below with some dark flank markings. Juvenile almost uniform blackish brown on underparts; first year birds have intermediate plumage.



operative hunting of pair reported.

Breeding. Laying Jan-Apr. Nests in variety of sites: old stick nests of other birds, especially corvids and other raptors; in trees; often near humans, on buildings, spires, towers, or even castles; on cliffs or rocky outcrops, sometimes on bare ledges; even in holes in earth banks; reports of present species constructing nests are certainly erroneous. Spectacular display flights include mutual soaring, rapid pursuit of female by male, and male diving on female. Usually 3-4 eggs (rarely 2 or 5); both sexes incubate; incubation and fledging periods unrecorded. Both parents hunt, female only when chicks older; female alone feeds chicks.

Movements. Sedentary.

Status and Conservation. Not globally threatened. CITES I. Uncommon to rare and local. Population declines noted in Pakistan and W India probably due to reduction of prey availability as result of extensive cultivation.

Bibliography. Ali & Ripley (1978), Brown & Amadon (1968), Cade (1982), Hue & Eichécopat (1970), Inskipp & Inskipp (1985), King *et al.* (1975), Lowther (1949), Paludan (1959), Ripley (1982), Roberts (1991), Smythies (1986).

57. Saker Falcon

Falco cherrug

French: Faucon sacre

German: Würgfalk

Spanish: Halcón Sacre

Other common names: Altai Falcon ("altaicus")

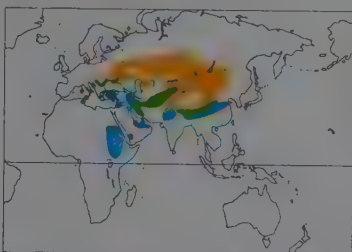
Taxonomy. *Falco cherrug* J. E. Gray, 1834, India.

Closely related to *F. rusticolus*, with which forms superspecies, perhaps also including *F. biarmicus*, *F. jugger* and possibly even *F. mexicanus*. Internal taxonomy very complicated and uncertain, especially with reference to populations of C Asia. Status of form "altaicus" controversial (see page 218); has been considered separate species, or race of *F. rusticolus* or of present species; now usually reckoned to be morph of present species; nevertheless, breeds significantly earlier than other nearby populations of present species. Possible races *coarsi* (from Uzbekistan) and *progressus* (EC Asia) apparently rather distinctive; several other races may be valid, including perhaps *cyanopus* (C & E Europe), and unnamed population from deserts E of Caspian Sea. Two subspecies currently recognized.

Subspecies and Distribution.

F. c. cherrug J. E. Gray, 1834 - C Europe E through SW Russia, Ukraine and Iran to R Yenisey and foothills of Altai; winters from Europe and NE Africa E to NW India.

F. c. milvipes Jerdon, 1871 - SE Siberia, N Mongolia and N China S to W & C China; winters from Iran E to Nepal and NW India, Tibet and C China.



Descriptive notes. 45-55 cm; male 730-990 g, female 970-1300 g; wingspan 102-129 cm. Plumage very variable; crown whitish to brown, streaked dark. Rather similar to slightly larger, stockier *F. rusticolus*, but generally browner, especially on upperparts; larger and more heavily built than *F. biarmicus* and *F. jugger*. Juvenile generally darker and more heavily streaked. Considerable geographical variation in plumage, but not well known; probably includes some morphs; form "altaicus" variable, but generally larger, more heavily spotted below, and darker, more blackish brown above, sometimes with rufous barring.

Habitat. Steppe, sometimes wooded, and even open woodland; abrupt rocky areas, e.g. cliffs and canyons. Occurs from plains and foothills to mountains and high plateaux, up to 4700 m. Wider range of habitats outside breeding season, but also essentially in open areas; sometimes along coast, over marshes or near lakes; hunting area can be some distance from nest or roost.

Food and Feeding. Mainly small mammals, particularly rodents and lagomorphs. In many areas susliks (*Citellus*) predominate; also gerbils, jerboas, hamsters, voles, lemmings and other rodents; young marmots and pikas in mountainous areas. Birds generally less important, mainly medium-sized and ground-dwelling birds, especially sandgrouse, gamebirds (partridges, quails, pheasants), corvids, pigeons and larks; lizards (e.g. *Uromastix*) locally important; Coleoptera also reported. Swoops on birds in air, but most prey caught on ground; watches for prey from vantage points, where may perch for hours. Also performs low foraging flights, looking for prey on ground; occasionally hovers.

Breeding. Laying in Apr-May. Nests on cliff ledges and crags; also nests in tall trees, particularly in W of range, occupying abandoned nests of other raptors, corvids or other birds; locally has switched from trees to pylons; can reuse same nest or move between various nests from year to year. Normally 3-5 eggs (2-6); replacement laying occurs; incubation over 30 days, mainly by female; male brings most of food, as female does not hunt until second half of nestling period; chicks have yellowish white first down, greyish white second down, fledging 45-50 days; young remain dependent on adults for another 30-45 days. Sexual maturity at 2-3 years, unusually at 1 year.

Movements. Mainly migratory or partially migratory; sedentary or dispersive in S of breeding range. Only occurs in winter in N Pakistan, Arabia, Africa (Sudan, Ethiopia, and N Kenya), and parts of Middle East and China. Leaves most areas of former USSR in Sept-Oct, although some pairs stay over winter, even in N regions, e.g. Khakasia; returns Mar-Apr; absence from warmer areas is shorter.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Despite apparent rarity, world population might number 35,000-40,000 pairs. Numbers and population trends not well known, particularly over extensive Asian breeding range, where bulk of population occurs; migrant populations in Asia may be declining, whilst resident populations perhaps stable or increasing. In first half of 20th century was locally abundant in both European and Asian sectors of USSR; in some areas of SC Siberia, relatively high densities of 5-7 pairs/100 km². Formerly more abundant in SE Europe: following fairly steady decline, moderate recovery in 1980's, particularly in Hungary, as result of protection efforts. Estimates include (early 1990's): 120-150 pairs in Ukraine, where decreasing due to deforestation and decrease in suslik populations; c. 100 pairs in European Russia; c. 20 pairs in Moldavia; c. 20 pairs in Romania; c. 50 pairs in Bulgaria; 20-40 pairs in former Yugoslavia; 90-150 pairs in Hungary (only 20 pairs in 1960's); 15-20 pairs in Czechoslovakia; and 1-5 pairs in Austria. Highly sought after by falconers, particularly in Arabia; resultant excessive trade may affect populations, through capture of birds, particularly females, and theft of chicks.

Bibliography. Bagura *et al.* (1994a, 1994b), Baumgart (1991b), Brown *et al.* (1982), Cheng Tso-hin (1987), Cramp & Simmons (1980), Dementiev & Gladkov (1951), Etchecopar & Hùe (1978), Flint & Sorokin (1994), Flint *et al.* (1984), Génsbel (1986), Goodman *et al.* (1989), Hadjichristou & Demetropoulos (1983), Kemp & Crowe (1993), Knyshtaus (1993), Kustov (1980), Mackworth-Præd & Grant (1957-1973), Meyer de Schauensee (1984), Paz (1987), Polushkin (1988), Popov & Verzhutskii (1990), Richardson (1990), Riddle & Remple (1994), Roberts (1991), Rogacheva (1992), Simeonov *et al.* (1990), Thiollay (1989c).

58. Gyr Falcon

Falco rusticolus

French: Faucon gerfaut

German: Gerfalk

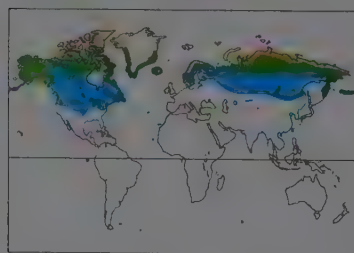
Spanish: Halcón Gerifalte

Other common names: Gyr, Jerfalcon

Taxonomy. *Falco rusticolus* Linnaeus, 1758, Sweden.

Forms superspecies with *F. cherrug*, and perhaps also *F. biarmicus* and *F. jugger* and possibly even *F. mexicanus*. Taxonomy very complicated; usually considered monotypic, but highly polymorphic. Sometimes considered polytypic, normally with four races, based mainly on colour frequencies: *rusticolus* (Europe); *obsolens* (Asia, parts of North America); *candicans* (high Arctic of North America, Greenland); and finally *islandus* (Iceland), the most isolated, uniform and distinctive of these forms, which would probably be most valid race. Morph "*altaicus*" of *F. cherrug* has been listed as race of present species; also considered to form link between these two species. Monotypic.

Distribution. Circumpolar, occupying Arctic regions of Eurasia, North America, Greenland and Iceland; some birds move farther S for winter.



Descriptive notes. 48-60 cm; male 961-1321 g, female 1262-2100 g; wingspan 120-135 cm. The largest *Falco*. Extreme polymorphism in coloration, with three main colours, white, grey and blackish brown. Streaked or barred on underparts; white birds with some dark markings on upperparts and underparts. Legs and feet yellow. Female larger, sometimes darker. Juvenile generally darker, browner and more heavily streaked below; legs and feet pale grey. The three main colour morphs vary and grade into one another, sometimes along clines, or at any rate with colour morph ratios differing regionally: birds

in high Arctic of Greenland usually white; in Labrador, preponderance is dark brown or even blackish; in Iceland, normally various shades of grey; clinal W to E across Russia and Siberia, with 90% grey drifting into 47% white; also slight variation in size, with larger birds in N of range.

Habitat. Three basic habitats for breeding are maritime, riverine and montane. Occurs widely over tundra and taiga, from sea-level to at least 1400 m. In winter, migrants moving S frequent farm and agricultural land and native steppe habitat.

Food and Feeding. Mainly birds and mammals. Frequently a major reliance on ptarmigan/grouse (*Lagopus*) and ground squirrels (*Spermophilus*) for breeding; in coastal areas, seabirds may be major food; lemmings (*Lemmus*, *Dicrostonyx*) can be mainstay in some areas depending on season. During winter food may be more restricted, where species resident, but more varied for those migrating S, where prey as large as Sage Grouse (*Centrocercus*) is killed. Most hunting by fast flight low over ground, often rising to make rapid stoop; sometimes forages by flying along high up, or perches to scan. Prey taken on ground or water more often than in air, but sometimes after hot pursuit.

Breeding. Mar-Jul, but territories may be held all winter so breeding essentially starts Jan-Feb. Solitary. Eggs laid in scrape or depression in cliff ledge, disused stick nest of another species on cliff, or occasionally stick nest in tree or on man-made structure, e.g. gold dredger or oil pipeline. Usually 3-4 eggs (2-7 in years of food extremes); incubation 34-36 days; chicks have white down; fledging 46-53 days. Nest success varies widely in response to cyclical food sources: 1.3-4.0 young per successful nest, but generally c. 2.5-3.1 over many years; occupation of c. 31-88% of total territories available; 38-73% of occupied territories produce young. Usually first breeds in second or third year; in Iceland, some breed by end of first year. Oldest wild birds c. 13 years old.

Movements. Many adults sedentary; juveniles generally more dispersive and move farthest S. Patterns complicated by cyclical food availability, which may cause irruptive movements, but some very clear movements, e.g. white morph birds from Greenland to Iceland. Some move from North America to Siberia (see page 237). May winter around edge of sea ice or near open water (polynyas). Most birds winter N of 52° N; in North America has reached S to 35° N, in Eurasia c. 46° N.

Status and Conservation. Not globally threatened. CITES I. Currently considered near-threatened. Widespread; rare in some regions, locally common in others but status confounded by cyclical nature of numbers. Densities vary regionally with rather wide ranging estimates of total population from c. 5000-7000 to 15,000-17,000 pairs. Some estimates are: Alaska (USA) 375-635 pairs; Yukon Territory (Canada) 750 pairs; Northwest Territories (Canada) 1300 pairs; Greenland c. 750 pairs; Iceland c. 350 pairs; Scandinavia c. 120-150 pairs; 50 pairs in European Russia, with only 10-15 pairs over area of 14,000 km² in extreme NE; no survey results for Siberia. Not affected by organochlorines during 1960's and 1970's, as were other *Falco*. Recent mortality at hands of trappers in Siberia (e.g. Yakutsk, Indigirka R) suggests that c. 1000-2000 killed annually throughout Arctic Russia. Highly prized in falconry, with unknown number taken annually; probably not enough to affect breeding population. Now bred in captivity for falconry and research in North America, Europe and Russia.

Bibliography. Banciello (1980), Benigson (1982), Benie (1981), Brazil (1991), Burman & Mattox (1984), Cade (1960, 1968), Cotter *et al.* (1992), Cramp & Simmons (1980), Dementiev (1960), Dementiev & Gladkov (1951), Dementiev & Gortchakovskys (1945), Dobler (1989), Ellis *et al.* (1992), Everett *et al.* (1989), Fletcher & Webby

(1977), Flint & Sorokin (1994), Flint *et al.* (1984), Garber *et al.* (1993), Génsbel (1986), Grybowski (1983), Jenkins (1978), Johnsgard (1990), Kalyakin & Vinogradov (1981), Kishchinskii (1958), Knyshtaus (1993), Kuyt (1962), Langvatn (1977), Langvatn & Moksnes (1979), Lindberg (1981), Mindell & White (1988), Moore, J. (1987), Mossop & Hayes (1982, 1994), Muir & Bird (1984), Nielsen (1986, 1991), Nielsen & Cade (1990a, 1990b), Nielsen & Petterson (1993), Palmer (1988), Parrish & White (1987), Platt, J.B. (1976c, 1977, 1989), Platt, S.W. (1977), Poole (1989), Poole & Boag (1988), Poole & Bromley (1988), Rogacheva (1992), Roseneau (1972), Sanchez (1993), Schmutz & Oliphant (1987), Shank & Poole (1994), Snyder & Wiley (1976), Swen *et al.* (1994), Tommeras (1978, 1989), Vaurie (1961b), White & Cade (1971), White & Nelson (1991), White & Weeden (1966), Woodin (1980).

59. Prairie Falcon

Falco mexicanus

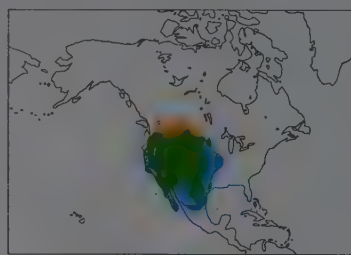
French: Faucon des prairies

German: Präriefalke

Spanish: Halcón Mejicano

Taxonomy. *Falco mexicanus* Schlegel, 1851, Monterey, Mexico = California.

Formerly placed in *Gennaia* or *Hierofalco*. May form superspecies with *F. jugger* and *F. biarmicus*, and perhaps also with *F. cherrug* and *F. rusticolus*; but probably closer to *F. peregrinus*. Monotypic. **Distribution.** SW Canada through W & WC USA to N Mexico; winters to EC USA and NC Mexico.



Descriptive notes. 37-47 cm; male 500-650 g, larger female 700-975 g; wingspan 95-105 cm. A typical rather large falcon; in flight, dark axillaries distinctive. Cere and legs yellow. Juvenile often darker brown, with underparts more buff-coloured; cere and legs pale bluish grey.

Habitat. Mainly arid hilly and mountainous grasslands and shrub-steppe, including vast desert valleys and farmlands, from sea-level up to 4000 m. Usually avoids urban areas and interior of forest.

Food and Feeding. Primarily mammals, particularly ground squirrels (e.g. *Citellus*, *Spermophilus*), and birds, particularly those of open habitats or flocking passerines, e.g. larks (*Eremophila*), longspurs (*Calcarius*), meadowlarks (*Sturnella*), starlings (*Sturnus*) and columbids; also reptiles, small lizards, and insects. Tends to forage by flying along at medium height; birds usually caught on or near ground after low angle stoop; sometimes after hot pursuit.

Breeding. Sometimes arrives at eyries in Feb, but normally Mar-Jul, depending on altitude and latitude. Solitary. Achieves high densities in Idaho (NW USA), where 200 pairs occur at 1 pair/0.65 km². Nests on cliffs, in pothole-like sites; also on rocky outcrops, or high riverbanks of earth and gravel; few, exceptional records on buildings (Canada), trees (USA, in Utah and Wyoming) and electric power pylons (USA, in Nevada). Eggs laid in depression or scrape or unused stick nest of raven (*Corvus*) or eagle. 3-5 eggs, rarely 6; incubation c. 31 days; chicks have white down, with dark feathers showing by 14 days old; fledging 36-41 days. Nesting success variable, with young produced in 64-93% of attempts, normally 71%; c. 2-75 young fledge per attempt; c. 31% of young die within average 44 days of having fledged. Sexual maturity usually at 2 years, but some females breed in 1st year. Oldest ringed bird 14 years.

Movements. Variable: disperses widely with general N to S movement from N breeding locations; movements in all directions from mid-latitude breeding locations; some sedentary tendency in S, but in general follows food supplies; some movements in response to aestivation, and hence inaccessibility, of ground squirrels; most birds breeding at altitudes above 2500 m move to lower ground in winter. Post-breeding vagrants wander outside breeding range more commonly in mid-continent plains region than elsewhere.

Status and Conservation. Not globally threatened. CITES II. Widespread and common within breeding range. Eggshell thinning as result of DDT caused only minor local reductions, although greater thinning at lower DDT levels than in *F. peregrinus*. Total breeding population estimated at 5000-6000 pairs, with greatest density in Idaho. Widely used in falconry, with no apparent effect on population.

Bibliography. Allen (1987), Allen *et al.* (1986), Beauvais *et al.* (1992), Boyce *et al.* (1986), Enderson (1964), Enderson & Berger (1970), Enderson & Wrege (1973), Fyfe, Campbell *et al.* (1969), Fyfe, Risebrough *et al.* (1988), Holthuijzen (1990, 1992), Holthuijzen *et al.* (1987), Johnsgard (1990), Lanning & Hitchcock (1991), MacLaren *et al.* (1984), Marti & Braun (1975), Moritsch (1983), Ogden & Hornocker (1977), Palmer (1988), Platt (1978, 1981), Porter & White (1973), Roppe *et al.* (1989), Runde (1987), Runde & Anderson (1986), Schmutz & Oliphant (1987), Schmutz *et al.* (1991), Snyder & Snyder (1991), Snyder & Wiley (1976), Squires *et al.* (1993), Steenhof (1992), Steenhof & Kochert (1988), Williams (1985), Wrege & Cade (1977).

60. Peregrine Falcon

Falco peregrinus

French: Faucon pèlerin

German: Wanderfalke

Spanish: Halcón Peregrino

Other common names: Barbary Falcon (*peregrinoides*); Kleinschmidt's Falcon ("*kreyenbergi*")

Taxonomy. *Falco peregrinus* Tunstall, 1771, Great Britain.

Formerly placed in separate genus, *Rhynchodon*. Race *peregrinoides* often considered separate species, usually incorporating race *babylonicus*, although latter has, in turn, been considered independent species; hybrids between *peregrinoides* and other forms of present species are infertile. Kleinschmidt's Falcon named as separate species, "*F. kreyenbergi*", but is actually colour morph of race *cassini*. Nineteen subspecies normally recognized.

Subspecies and Distribution.

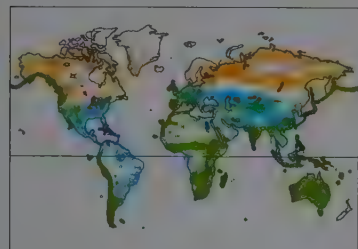
F. p. tundrius C. M. White, 1968 - Arctic tundra of North America, from Alaska to Greenland.
F. p. anatum Bonaparte, 1838 - North America S of tundra to N Mexico, except NW Pacific Coast.
F. p. pealei Ridgway, 1873 - coastal W North America from Washington N to W Alaska, and W through Aleutian and Commander Is; possibly also coastal Kamchatka and Kuril Is.
F. p. cassini Sharpe, 1873 - W South America, from Ecuador (locally) S through Bolivia and N Argentina to S Chile, Tierra del Fuego and Falkland Is.
F. p. japonensis Gmelin, 1788 - NE Siberia S to Kamchatka and Japan (may not be race of coastal Kamchatka).

F. p. furutitii Momiyama, 1927 - Volcano Is and possibly Bonin Is.

F. p. calidus Latham, 1790 - tundra of Eurasia, from Lapland E to NE Siberia, roughly to region of R Yana and R Indigirka.

F. p. peregrinus Tunstall, 1771 - Eurasia S of tundra and N of Pyrenees, Balkans and Himalayas, from British Is E to Amurland and Ussurland in Russian Far East.

- F. p. brookei* Sharpe, 1873 - S France, Spain and coastal N Africa E through Mediterranean to Caucasus.
F. p. babylonicus P. L. Sclater, 1861 - Asia, from E Iran to Mongolia.
F. p. peregrinoides Temminck, 1829 - Canary Is E through inland N Africa to Iraq, and probably Iran.
F. p. madens Ripley & Watson, 1963 - Cape Verde Is.
F. p. minor Bonaparte, 1850 - Africa S of Sahara, and N into extreme S Morocco.
F. p. radama Hartlaub, 1861 - Madagascar and Comoro Is.
F. p. peregrinator Sundevall, 1837 - Pakistan, India and Sri Lanka E to SE China.
F. p. ernesti Sharpe, 1894 - Indonesia and Philippines E to New Guinea and Bismarck Archipelago.
F. p. nesiotis Mayr, 1941 - Vanuatu and New Caledonia (race uncertain) E to Fiji.
F. p. macropus Swainson, 1837 - Australia (except SW).
F. p. submelanogenys Mathews, 1912 - SW Australia.



Descriptive notes. 34-50 cm; c. 550-1500 g; wingspan 80-120 cm. Large, stocky falcon, with relatively short tail; prominent moustache usually evident in all ages. Rather variable, with upperparts various tones of blue, grey or black; underparts white to rufous crossed with variable bars. Noticeable size dimorphism, with female 15%-20% larger than male. Juvenile has upperparts with tones of black to pale brown; underparts streaked. Races separated on size and colour: smallest, palest (tannish) forms in deserts of Eurasia and African region; largest in Pacific NW North America and Aleutian Is; darkest (deep

red and black) in Old World tropics and extreme S South America.

Habitat. Extremely variable: breeds from hot tropics to cold, wet marine habitat; arid hot or cold deserts; from sea-level to c. 4000 m. Found almost anywhere during migration, even landing on ships in C Pacific Ocean. Unexpected gaps in breeding distribution, e.g. Iceland, Newfoundland, tropical Central and South America, and New Zealand.

Food and Feeding. Chiefly birds; occasionally mammals, including bats (both Megachiroptera and Microchiroptera), rats, rabbits and voles; also insects (Orthoptera, Odonata), reptiles (lizards) and exceptionally fish; two reports of carrion feeding. More than 300 bird species known to have been taken in N Hemisphere; locally or regionally specializes on certain groups, notably pigeons and doves (Columbiformes), parrots (Psittaciformes), auks (Alcidae) and petrels (Procellariiformes) or on particular species, e.g. European Starling (*Sturnus vulgaris*); overall, Columbiformes seem to be principal prey group. Avian prey range 10-2000 g; males tend to catch birds of 20-300 g, and females of 100-1000 g. During breeding season, males normally catch prey c. 20% of their own body weight. Birds taken mainly in flight: when searching for prey, often flies high or perches at prominent site; prey once located, typically pursued at great speed, frequently culminating in very rapid stoop; prey normally killed in mid-air, but sometimes on ground or water. Many other techniques recorded, including hawking for insects, hovering and quartering.

Breeding. Laying Feb-Mar in N temperate zone, Apr-May at N high latitudes; Aug-Oct in S Hemisphere; recorded Jun-Dec at equator. Pairs maintain breeding territories, with eyries usually more than 1-2 km apart, but sometimes only a few hundred metres apart in British Columbia (Canada). No nest built; eggs laid in scrape or depression on cliff, occasionally in disused stick nest of another species, in tree hollow (e.g. in Australia), or on ground (e.g. Baltic area); nests on buildings in urban areas, or on other man-made structures, e.g. bridges. Clutch size larger in N Hemisphere, averaging 3-40 in *tundrius* of Arctic, but 2-81 in *macropus* of Australia; incubation 29-32 days; in middle to low latitudes, replacement of lost clutch may occur within 2 weeks; chicks have white down, later replaced with second, greyer down; fledging 35-42 days; chicks may remain dependent on parents for 2 months. Adult male provides most of food during first half of nesting period. Success: 1-74 young per attempt in Arctic (*tundrius*); 1-63 young per attempt in S Hemisphere (*macropus*). First breeding normally at 2 years old or more; females typically start at younger age than males, and yearling breeders mainly females; at least one record of successful breeding of yearling pair (9-10 months old).

Movements. Highly migratory in N temperate and Arctic zones: N American races *anatum* and *tundrius* moving to C Argentina and Chile for austral summer; common around Manaus during boreal winter; Eurasian races *peregrinus*, *calidus*, and *japonensis* migrate to C Africa, S Asia and Indonesia; birds may spend 6-7 months in S non-breeding latitudes. In middle latitudes and S Hemisphere, mainly resident and sedentary. Resident at some N latitudes, e.g. Aleutian Is. Pairs may remain together throughout year. Dispersal from natal or breeding areas is greater in first year birds; females disperse farther than males, and, once adult, males have higher nest-site fidelity.

Status and Conservation. Not globally threatened. CITES I. Total breeding population worldwide conservatively placed at c. 12,000-18,000 pairs in 1980's, with main concentrations in Australia, islands of N Pacific and Bering Sea, Spain and British Is; populations have certainly increased since then. Currently c. 700 pairs in European Russia, with only 20-25 pairs over area of 14,000 km² in extreme NE; 20-30 pairs in Azerbaijan; in 1989 in Scotland, 373+ young raised to fledging at 375 known occupied nests. Historically, populations very stable, and wide fluctuations were unknown. Serious declines occurred from mid-1960's to mid-1970's (see page 246), as a result of eggshell breakage, mortality of embryos and some mortality of adults from chlorinated hydrocarbon contamination. Chemicals were banned in most countries, and numbers currently returning, or have already returned, to pre-chemical levels, even overshooting historical population numbers (see page 247). Race *madens* thought to number only 6-8 pairs; *furuittii* local and rare, thought to breed only on one island, and may be threatened. Race *nesiotis* very uncommon, with probably less than 100

pairs scattered over 51,610 km² of land, and much larger area of ocean. By 1972, races *anatum*, *tundrius* and *peregrinus* listed as endangered. Because of similarity of appearance, entire species still listed as endangered by CITES in 1990. Bred extensively in captivity worldwide; as many as 5000 captive-bred birds released to wild. Used extensively in falconry; impacts continuously and heatedly debated, on meager data. Extinct in Byelorussia since 1974.

Bibliography. Albuquerque (1978), Ali & Ripley (1978), Anon (1992), Beebe (1960), Bell (1990), Bergier (1987), Blake (1977), Boyce (1985), Bradley & Oliphant (1991), Brazil (1991), Bregulla (1992), Brusset (1986), Brown *et al.* (1982), Burnham & Mattox (1984), Cade & Bird (1990), Cade *et al.* (1988), Cameron & Olsen (1993), Coates (1985), Cooke (1979), Cramp & Simmons (1980), Czechura (1984), Dee (1986), Dementiev & Gladkov (1951), Dementiev & Iljitshev (1961), Ellis (1982), Ellis & Peres (1983), Emison *et al.* (1993), Etchécopar & Huc (1978), Falkenberg *et al.* (1994), Fjeldså & Krabbe (1990), Flint *et al.* (1984), Gónshol (1986), Ginn *et al.* (1989), Goodman *et al.* (1989), Handrinos & Demetropoulos (1983), Hantge (1968), Hickey (1969), Hilgert de Benavides (1989), Holland (1989), Hollands (1984), Hull (1993), Husler (1983a, 1988), Johnsgard (1990), Johnson (1965, 1972), Kelly & Thorpe (1993), King (1978/79), Langrand (1990), Lindberg (1975), MacKinnon (1988), Mackworth-Praed & Grant (1962), Maclean (1993), Marchant & Higgins (1993), van Marle & Voous (1988), McNutt (1984), Miron *et al.* (1973), Monney & Brothers (1987), Monneret (1987), Nelson & Myers (1976), Newgrain *et al.* (1993a), Olsen, J. & Georges (1993), Olsen, J. & Olsen, P. (1980), Olsen, J. *et al.* (1993), Olsen, P. (1982, 1993b), Olsen, P.D. & Cockburn (1991), Olsen, P. & Olsen, J. (1978, 1979, 1988), 1989a, 1989b), Olsen, P. & Peakall (1983), Palmer (1988), Patrikeev (1993), Paz (1987), Peakall & Kiff (1979), Pfeiffer (1991), Pinto (1964), Porter & White (1973), Porter *et al.* (1987), Potapov (1994), Pratt *et al.* (1987), Pruett-Jones *et al.* (1981a, 1981b), Ratcliffe (1993), Risebrough *et al.* (1990), Roberts (1991), Rogacheva (1992), Shank *et al.* (1993), Sherrod (1983), Sick (1985a, 1993), Simeonov *et al.* (1990), Slud (1964), Smythies (1986), Snyder & Snyder (1991), Snyder & Wiley (1976), Tarboton (1984), Vasina & Stranec (1984), Vaurie (1961a), Walker *et al.* (1973), Weick (1989), Wendi & Septon (1991), Wegner (1994), Weimore (1965), White, C.M. (1975), White, C.M., Pruett-Jones & Emison (1981), White, C.M., Parrish *et al.* (1993), White, C.M.N. & Bruce (1986), Wootton & Bell (1992).

61. Taita Falcon

Falco fasciinucha

French: Faucon taita

German: Taitafalke

Spanish: Halcón Taita

Other common names: Teita Falcon

Taxonomy. *Falco fasciinucha* Reichenow and Neumann, 1895, Taita Hills, Kenya.

Most similar to *F. severus*, with which might form superspecies. Monotypic.

Distribution. S Ethiopia through Kenya, Uganda, Tanzania, Malawi, E Zambia, SW Mozambique and Zimbabwe to NE South Africa.



Descriptive notes. 25-28 cm; male 212 g, female 306 g. Small, stocky, short-tailed falcon with pale grey rump, white throat and rufous patches on nape. Smaller than *F. peregrinus*, which has dark rump and no rufous neck patches (in most races), and is heavily marked below; also smaller than *F. biarmicus*, which has paler underparts and chestnut confined to the crown. Female less strongly coloured than male. Juvenile has upperparts edged with buff, flanks more heavily streaked, nape patches paler, and rump as dark as back.

Habitat. Favours high cliffs and gorges up to 3800 m for roosting and nest-sites, but hunts

widely over surrounding dry woodland and savanna.

Food and feeding. Mainly small birds of 80-120 g, especially swallows and swifts, but including Purple-crested Turaco (*Tauraco porphyreolophus*) of 270 g; also takes a few large insects. Takes all prey aerially, by a fast stoop with rapid, shallow wingbeats, from a perch or from high, soaring flight; pairs may hunt co-operatively. Spends long periods perched inactive on cliff face, where also caches some prey.

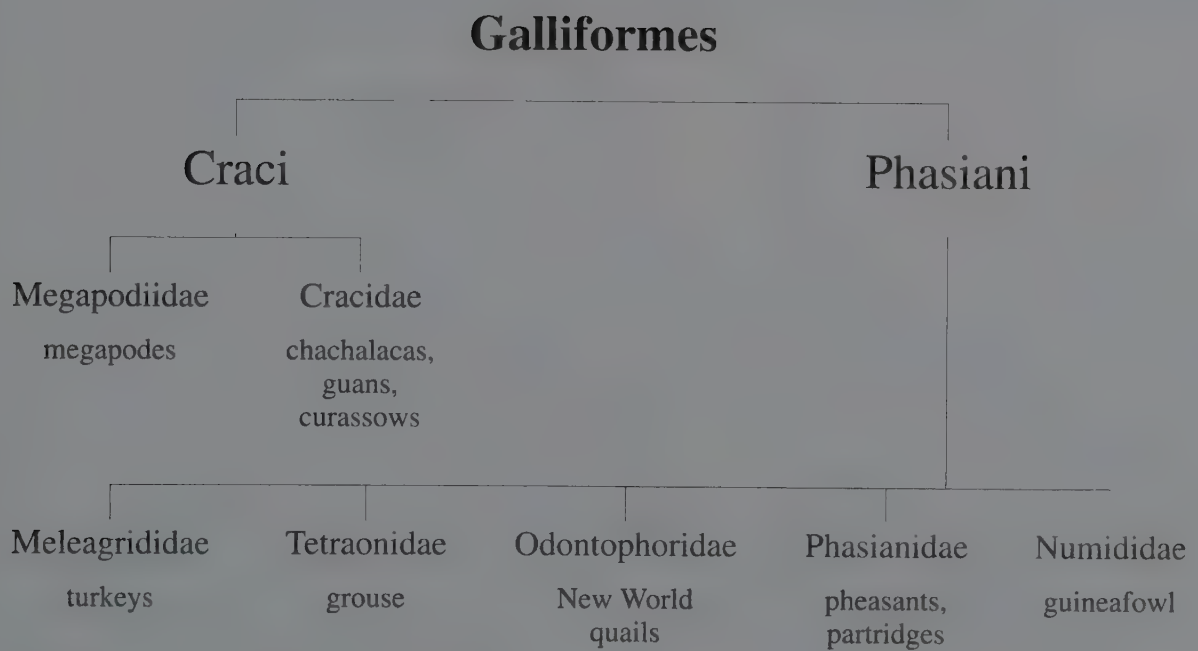
Breeding. Laying Apr-Jul in E Africa; Aug-Oct in S Africa. Favours a scrape or old stick nest at the back of a shaded hole, usually high on a cliff above a gorge, or on a mesa. Very defensive at nest; shares similar site requirements with *F. peregrinus*. 2-4 eggs; incubation 31-33 days; chicks have grey down, paler at first; fledging 42 days; female assists in feeding of chicks during fledging period of at least 3 weeks. Productivity of 0-88 chicks per pair per year, over 9 pair-years in Zimbabwe.

Movements. Pair usually resident within territory, but some sites occupied sporadically and records far from known breeding sites suggest some local movement.

Status and Conservation. Not globally threatened. CITES II. Currently considered near-threatened. Extremely localized and easily overlooked throughout most of its wide range, e.g. in Kenya, where not recently recorded from Taita (Teita) Hills, where originally collected. Only known to be relatively common on Mt Elgon in Uganda (4 pairs) and along the Batoka Gorges of the R Zambezi (8-10 pairs in 60 km) on the Zambia-Zimbabwe border, where may be threatened by proposed dam. Estimated 20-50 pairs in Zimbabwe, and recently found breeding further S in South Africa. Effects of pesticide use unknown but currently being monitored.

Bibliography. Benson & Benson (1975), Benson & Smithers (1958), Brooke & Howells (1971), Brown *et al.* (1982), Cade (1982), Colebrook-Robjent (1977), Dowsett (1983), Ginn *et al.* (1989), Hartley (1991, 1993), Hartley & Heinrich (1992), Hartley *et al.* (1993), Holliday (1965), Hunter *et al.* (1979), Jenkins *et al.* (1992), Lewis & Pomeroy (1989), Mackworth-Praed & Grant (1957, 1962), Maclean (1993), Madge (1971), Möller (1989), Pickford *et al.* (1989), Ripley & Heinrich (1966), Speer (1988), Steyn (1982), Weick (1989), Woodall (1971).

Order GALLIFORMES



Class AVES
Order GALLIFORMES
Suborder CRACI
Family MEGAPODIIDAE (MEGAPODES)



- Medium-sized to large terrestrial birds with large, powerful legs and feet and sharp claws.
- 28-70 cm.



- Australasian Region, with greatest diversity in Australo-Papuan Subregion; lone outpost in Oriental Region.
- Tropical forest, mostly in lowlands; one species occupies semi-arid woodland and scrub.
- 7 genera, 19 species, 35 taxa.
- 8 species threatened; none extinct since 1600.

Systematics

The Megapodiidae are the most distinctive members of the Galliformes, and they are often considered to be the most primitive. They form a well defined, rather homogeneous group of some nineteen species, which are closely united not only by morphology, but also by their unique breeding habits and their distribution.

The megapodes are found almost exclusively in the Australasian Region, mainly in the Australo-Papuan Subregion, and there is little reason to suppose that they were ever much more widespread, although their Pacific range has certainly been reduced (see Relationship with Man). A claim that fossil remains found in France belonged to a megapode led to a series of conjectures about possible implications, but after closer scrutiny it appears that the claim was unfounded.

There are two main theories about the origins of the megapodes, which are to a large extent dependent on opinions regarding the origins of the order. The cracids are thought to have originated in North and Central America, before colonizing South America (see page 310), their current focus of diversity, and this has been used as the basis for suggesting that megapodes may have reached their present range by moving down from North America through south-east Asia. However, the dubious authenticity of the supposed fossil megapode from France has removed a major stumbling block for those who argue instead that the order arose in Gondwanaland, the ancient austral super-continent that was in the process of breaking up about 100 million years ago, in the Cretaceous. If the theory of a Gondwanan origin is accepted, then the megapodes' occupation of Australia and subsequent colonization in the outlying islands are simple steps. In any case, it is generally agreed that the megapodes must have been isolated in Australasia since the Miocene, a period during which Australia was covered in tropical forest and so offered ideal conditions for the mound-building habit to develop.

Diversification within this family seems to have been centered in the area around New Guinea. Indications of this are the large number of species present, but more importantly the two endemic genera, *Aepyodius* and *Talegalla*, respectively containing two and three species. Australia too has two endemic genera, *Alectura* and *Leipoa*, but both of these are monotypic, while *Leipoa* is the least typical of all megapodes, a specialized form that may well have evolved from forest-dwelling ances-

tors. These factors together suggest that Australia is less likely to have been the main scene of megapode diversification.

Moving away from this focal area, the genera are rapidly reduced merely to the wide-ranging *Megapodius* and the very closely related, possibly congeneric *Eulipoo*, which occurs only to the west. Across into the Pacific, megapodes appear to follow the general trend of other families in the zone, whereby species richness decreases steadily as one moves eastwards. Nevertheless, over the centuries the activities of man have contributed to mask the original distribution of megapodes at both its eastern and western limits (see Relationship with Man).

The limited fossil evidence available so far for the family serves to indicate a more extensive Pacific range, with extinct species known from New Caledonia, Fiji and Tonga, as well as from south-east Australia. Interestingly, *Sylviornis neocaledoniae*, a huge, flightless Holocene species from New Caledonia, was originally thought to have been a ratite, but was then classed as an outsize megapode, possibly measuring about 165 cm from bill tip to tail tip. With much more material now available, it is not actually clear that it was a megapode, but it probably does represent some kind of primitive galliform. As other galliform families are virtually absent from the Australasian Region, this bird could have been one of the primitive forerunners of the Megapodiidae, although its relationship with the family remains to be proved. The earliest fossil material of megapodes discovered to date comes only from the Upper Pleistocene of Australia.

The extraordinary incubation strategies of the megapodes, in particular their use of the heat that is generated as plant matter decays (see Breeding), have led to much debate as to the origins of the family, and the postulation of direct links with the reptiles, which use a similar system for incubating their eggs. However, the apparently close relationship of megapodes with other Galliformes, together with the almost universally accepted premise that the Palaeognathae, comprising the ratites and the tinamous, constitute the most primitive extant element of the class Aves (see Volume 1, page 76), indicates that it is extremely unlikely that the megapodes' incubation strategy was inherited directly from reptiles, and rather that it is probably a case of parallel, or convergent, evolution. The alternative, that the megapodes branched off from the main line of avian evolution before all other birds, has almost the entire weight of centuries of ornithological investigation against it.

Brightly coloured bare facial skin is found in many megapodes, but it reaches its maximum expression in the Australian Brush-turkey, which has the entire head and neck bare, apart from a rather sparse covering of bristle-like feathers; it also sports an inflatable yellow pouch at the base of the neck. These features are particularly colourful in the male, especially during the breeding season, when they play an important part in display.

[*Alectura lathami lathami*.
Photo: C. B. & D. W. Frith/
Bruce Coleman]



The Cracidae, the next most clearly defined galliform family, may constitute the sister group of the megapodes, an idea supported by studies of the musculature of the wing and DNA-DNA hybridization among others. In classifications, this is usually reflected by the order being divided into two suborders, with one for the megapodes and cracids and the other for all the remaining Galliformes, which are frequently lumped together into an enlarged version of the family Phasianidae (see page 434). A conflicting view proposes three suborders, with one each for megapodes and cracids, and the third for the remainder. To add to the confusion, studies of osteology, feather microstructure, eggshell structure, egg-white proteins, uropygial gland secretions and feather lice in turn suggest that the megapodes should be treated as the sister group of all other Galliformes, so for the time being the debate continues, as the evidence accumulates.

In recent years, partly as a result of an upsurge of interest in the megapodes, the internal structure of the family has undergone a series of changes. Nevertheless, the majority of the different forms remain very poorly known, so the classification of the family as a whole is still, to some extent, in a state of flux.

The family may be subdivided into three natural groups: the first, the brush-turkeys, comprises the genera *Alectura*, *Aepyodius* and *Talegalla*; the second is made up of the rather distinctive monotypic *Leipoa*; while the third, the scrubfowl, contains the widespread polytypic *Megapodius*, the apparently very closely related monotypic *Eulipoa*, and the also monotypic *Macrocephalon* of Sulawesi. All members of the first group have a naked oil-gland, are eutaxic and are mound-builders; *Leipoa* is similarly eutaxic and a mound-builder; members of the third group have a tufted oil-gland, are diastataxic, and use a variety of incubation systems. The usefulness of the oil-gland as a taxonomic feature may be limited in this family, as it can be difficult to draw the line between the states "slightly feathered" and "unfeathered"; for this reason it has not yet been established which of these character states is applicable to *Leipoa*.

One matter that is increasingly attributed taxonomic significance is the variety of different incubation strategies followed, and this has led to a series of conjectures about the relative

ages of various genera (see Breeding). Another feature with taxonomic value is the different feather lice species present, as these tend to be highly host-specific, parasitizing only one or a few closely related species. The evidence from feather lice, although incomplete, also supports the clear separation of *Megapodius* from the three brush-turkey genera. More extensive data may provide further clues about all generic relationships. However, conflicting opinions regarding the taxonomy of the lice themselves make the situation much more complicated.

Most of the genus and species limits are fairly clearly defined and agreed upon, but the genus *Megapodius* has been extensively rearranged on several occasions. A version put forward by E. Mayr in the late 1930's, whereby the genus was reduced to merely three species, remained prevalent for many years. Mayr recognized the two rather distinctive Pacific species, the Micronesian Scrubfowl (*Megapodius laperouse*) and the Polynesian Scrubfowl (*Megapodius pritchardii*), but lumped all the other forms within the Dusky Scrubfowl (*Megapodius freycinet*). In the meanwhile, the Moluccan Scrubfowl (*Eulipoa wallacei*) was retained in its own separate genus, mainly on the grounds of its more distinctively marked plumage.

A reappraisal of the genus *Megapodius* in the mid-1980's by C. M. N. White and M. D. Bruce led to its redistribution into eleven species, with *Eulipoa* incorporated. However, the latest thinking suggests that it may be best to recognize a further three species of *Megapodius*, with the promotion of the forms *tenimberensis* and *forstenii*, hitherto included in the Orange-footed Scrubfowl (*Megapodius reinwardt*), and the form *geelvinkianus*, currently classified as a race of the Dusky Scrubfowl. Megapode specialists have also concluded that the Moluccan Scrubfowl is indeed sufficiently distinct to merit a separate genus. Interestingly, at the specific level evidence from feather lice emphasizes that, in the absence of material for the Polynesian Scrubfowl, the Micronesian Scrubfowl is clearly the most distinctive form within the genus *Megapodius*.

However, the last word has not been said on the systematics of this confusing genus. As most of the different forms are separated from their congeners by stretches of open sea, and as these are birds of relatively limited mobility (see Move-

ments), in many cases it is largely a matter of personal preference whether or not any particular form should be classed as a different species. For instance, White and Bruce state that the splitting off of the Philippine Scrubfowl (*Megapodius cumingi*) as a separate species from the Nicobar Scrubfowl (*Megapodius nicobariensis*) is essentially a matter of geographical convenience, and that, were their ranges contiguous, there would be only very weak grounds for their division into two species.

Morphological Aspects

In general, the Megapodiidae are rather similar in morphology to most other Galliformes. This standardized design was apparently perfected for a terrestrial way of life at an early stage and has undergone only relatively limited modifications since.

Megapodes are medium-sized to large terrestrial birds. The largest members of the family are those of the genera *Alectura* and *Talegalla*, and the Australian Brush-turkey (*Alectura lathami*) can measure up to 70 cm long and weigh about 2450 g. Amongst the smallest species are the Moluccan Scrubfowl, which measures only about 30 cm, and the diminutive Micronesian Scrubfowl, which can be only 28 cm in length or less. Adults of these smaller scrubfowl species almost certainly weigh under 500 g.

Megapodes have the plump body that is so typical of the Galliformes and has led to many members of the order becoming the standard gamebirds of hunters in various different regions. This shape seems to be closely allied to a fairly terrestrial way of life, as heavily built birds are not well designed for flying. It may also suggest a diet based primarily on plant matter, as this is more difficult to assimilate than animal food, so herbivores usually have to eat greater quantities than carnivores, and, as a direct result, have more voluminous bodies.

The head is relatively small, and the bill fairly short, stout and unspecialized, as in most other Galliformes. It is thought that either on the tongue or in some other part of the mouth there are some highly sensitive areas. Both when preparing the mound for egg-laying and during the lengthy incubation period, a bird will dig a small hole in the mound, into which it sticks

its head. It is suggested that sensitive parts in the mouth may well enable the bird to gauge the temperature of its mound with a remarkable degree of accuracy. An indication of this implied ability is the fact that mound temperatures remain surprisingly constant for months on end (see Breeding). In most megapodes, the nostrils are large, oval and longitudinally elongated. However, the apparently closely related genera *Alectura* and *Aepyodius* have round nostrils, an unusual feature in the Galliformes.

Many species have bare facial skin, although it varies greatly in extent between the species. The Polynesian Scrubfowl, for example, has reddish facial skin which just shows through between the feathers in places. In contrast, the Australian Brush-turkey has the whole of the head and most of the neck bare apart from a sparse covering of bristles, and these bare areas take on particularly bright shades of scarlet and yellow during the height of courtship, especially in the male when he is advertising his ownership of the mound and attempting to attract females. Part of the bare skin in this species covers a bulky throat pouch, again considerably more prominent in the male, and this is spectacularly inflated during booming (see Voice).

In Bruijn's Brush-turkey (*Aepyodius bruijnii*) the bare skin of the face and neck is embellished with long, pendant wattles, and the Wattled Brush-turkey (*Aepyodius arfakianus*) is similarly, though perhaps less spectacularly, decorated, the bluish white facial skin offsetting its otherwise dark appearance. Both species also sport a reddish comb, which is particularly prominent in the male during the breeding season. The three species of the genus *Talegalla* are almost identical in plumage, but differ in the extent and colouring of their bare parts: the face varies from black to reddish brown to yellowish green, and the legs and feet from reddish to yellowish.

Perhaps the most unusual adornment of the head is that found in both sexes of the Maleo (*Macrocephalon maleo*). It consists of a black bony knob projected backwards in the form of a skullcap, and reaching forwards down the forehead towards the juncture with the bill. This knob is mainly hollow, with a pneumatized spongy filling, producing a tough, but rather lightweight crown. The arrangement is strikingly offset by the reddish pink and yellow of the bill and eye-ring. The function



Although megapodes are almost exclusively terrestrial, several species react to potential dangers by flying up into nearby trees, and, in addition, some are known to have regular communal roosts in trees. The scrubfowl (*Megapodius*) seem to be the ablest fliers in the family, which ties in with their smaller body size. Note the powerful legs of this Orange-footed Scrubfowl, and the long, sharp claws, well designed for grasping quantities of nesting material and hurling them backwards onto a mound.

[*Megapodius reinwardt*.
Photo: D. & V. Blagden/
NHPA]

Like other megapodes, the Malleefowl lives almost all of its life at ground level, but it is unique in many ways. Whereas other megapodes most typically occur in tropical rain forest, this species is found much further south in semi-arid woodland and scrub, most notably in areas of mallee, a dwarf form of Eucalyptus. In connection with this different habitat, the Malleefowl presents a beautifully marbled plumage, in marked contrast with the rather drab colours seen in other members of the family.

[*Leipoa ocellata*, Australia.
Photo: John Cancalosi/
Bruce Coleman]



of the Maleo's peculiar knob is unknown, but it has been suggested that, as in some rather similarly equipped woodpeckers, it might act as a kind of shock absorber, when the bird is pecking forcefully at hard-shelled nuts.

Many species show some form of a feathered crest, and this may be highly conspicuous and pointed, as in the Orange-footed Scrubfowl. In contrast, it is scarcely visible in its congener the Philippine Scrubfowl, or in the Malleefowl (*Leipoa ocellata*).

The wings are large and rounded. Flying abilities vary within the family, but without ever reaching great levels of proficiency, as is the norm in the other members of the order. Generally, megapodes are better equipped for a fast take-off, in order to escape predators, than for flying long distances. Typically, when disturbed, a bird flies a fairly short distance up into the trees. However, inter-island movements within archipelagos are apparently carried out with some regularity, although perhaps only by scrubfowl, the smallest megapodes (see Movements). The larger members of the family, such as the Australian Brush-turkey, find it difficult enough to get off the ground, and rarely manage more than to flutter laboriously up into a tree, and then perhaps move on from one tree to another.

The form of the tail varies considerably between the different genera. In *Megapodius* it is particularly short, and is presumably of limited use. At the other extreme, the large brush-turkeys of the genera *Alectura*, *Aepyodius* and *Talegalla* have longish, rounded, rather bulky tails, which at any rate in some species can be opened and raised or tilted vertically during displays, making the bird appear noticeably larger; in contrast, the Wattled Brush-turkey's display involves concealing the tail under an outspread wing. The tail consists of twelve rectrices.

Perhaps the outstanding physical features of the family are the very strong legs and feet that all of the species possess. This is recalled in the very name "Megapode", which comes from the Greek for "big foot". The strength of the legs, and indeed of the birds in general, is amply demonstrated by their ability to shift large, heavy objects, such as dead branches, and the Orange-footed Scrubfowl, a species weighing about 550-1200 g, has been recorded digging up a stone that weighed 6920 g, and shifting it over a distance of 70 cm.

The evolutionary function behind the development of the legs and feet was presumably the nesting habits of the family. There are two different types of activity connected respectively with mound-building and the digging of burrows. The first system involves the bird grasping handfuls of material and hurling them backwards onto the mound or off it, as the moment requires. The second is rather a question of digging burrows in sand or soil, merely scraping the sand backwards and out, and subsequently scraping some of it in again. The Maleo has a small amount of basal webbing to the toes and rather short claws, which suggest that its feet are well developed for digging in the sand, as it habitually does for the purpose of laying its eggs. In contrast, all scrubfowl have long, sharp claws, which are useful for picking up material to throw onto a mound, but are less appropriate for digging in sand; this is true even of the Melanesian Scrubfowl (*Megapodius eremita*) and the Moluccan Scrubfowl, which are both habitual burrow-nesters, rather than mound-builders. With the support of this evidence it has been postulated that mound-building was the earlier form of incubation to develop (see Breeding).

The hallux, or hind toe, is on the same level as the front toes, and over the years this characteristic, which is shared with the Cracidae, has been one of the strong reasons for separating these two groups off from the other families of the order Galliformes, in which the hallux is raised above the level of the other toes.

As already stated, megapodes are clearly adapted to a largely terrestrial way of life, and all species spend most of their time wandering about on the ground. It is said that the Nicobar Scrubfowl, for instance, is a strong runner, and that it prefers to run away rather than to fly to safety, although when necessary it is capable of strong flight. The Black-billed Brush-turkey (*Talegalla fuscirostris*) too normally escapes from danger by dashing away in zig-zags through the undergrowth.

In general, the plumage found in this family is a very drab combination of brown, black and grey. This is in keeping with the birds' occupation of areas of dense undergrowth and particularly shady parts of the forest floor, where bright, conspicuous colouring could be hazardous, especially in terms of making it easier for potential predators to determine the whereabouts of an incubation mound. The only major exception

proves the rule: the Malleefowl has much more handsome plumage, with an attractive scaled pattern on the upperparts, and its colour scheme ties in very suitably with the fact that, unlike any other megapodes, it is found primarily in semi-arid woodland and scrub (see Habitat).

The sexes are generally very similar or even identical, although males tend to average slightly larger, are often more brightly coloured, and may have more prominent wattles. In this aspect megapodes would appear to obey the rule in Galliformes, whereby the species with the least dimorphism in size and colour are normally monogamous (see page 440); the slightly more marked dimorphism in the Australian Brush-turkey is thus in accordance with its polygamous tendencies (see Breeding). Again as a consequence of the megapode breeding strategy, the highly precocial juveniles, on emerging from the mound or the egg-burrow, are already clothed in a plumage similar to that of their parents, and they are soon, in effect, like miniature adults.

At present, little is known about moult in this family, and this is one of the many areas in which studies are at present being directed. So far most of the investigation carried out has been on skins in museum collections. Primary moult is serially descendant, and, as in other Galliformes and also in tinamous, touracos and the Hoatzin (*Opisthocomus hoazin*), the two outermost primaries, which first appear rather late in juveniles, are not replaced during the post-juvenile moult, and in fact remain in position until all the other primaries have been moulted for the second time. To date, the sequence of moult in the secondaries and the tail feathers has not been established. Further work in the whole of this field is likely to have useful implications for the external and possibly also internal taxonomy of the megapodes. The Australian Brush-turkey moults during March and April, between the end of one breeding season and the start of the next.

Males of both the Australian Brush-turkey and the Malleefowl have a form of penis, whereas the limited evidence available suggests that this is not the case in *Megapodius* scrubfowl.

Habitat

The typical habitat of the Megapodiidae is the floor of tropical rain forest. Almost all species use this as their foraging habitat, and for most it also serves as breeding habitat, but some species have learnt to take advantage of solar or volcanic heat and go to sandy beaches to lay their eggs (see Breeding).

In fact, a variety of forest types and wooded areas can provide suitable habitat. For instance, on the small island of Komodo, in the Lesser Sundas, the Orange-footed Scrubfowl lives and breeds in fairly dry open woodland and thickets, sometimes building its mounds only about 100 metres from villages; elsewhere, the same species can even occur in areas as damp as mangrove swamps.

It is generally thought that optimum habitat for most megapodes, at any rate mound-building species, implies an area with suitable plant material for the building and maintenance of the mound, and perhaps below a closed canopy, to avoid the mound overheating or drying out. Material is always added to the mound from the immediate vicinity, and never brought in from further afield, so there must be a plentiful supply of fresh material throughout the breeding season. An adequate food supply is also a major necessity, particularly as the male or the pair often stay very close to the mound for most of the year, and in some scrubfowl the pair may maintain a well defined feeding territory (see General Habits). The female, in particular, requires considerable resources in order to be able to carry out successful egg production throughout the appropriate period.

The precise requirements of burrow-nesters are much less clear, partly because these species are less visible most of the time, so their ecology is probably more difficult to study. For breeding, they require a suitable naturally warm site, which can range from a beach of black sand to areas influenced by geothermal heat sources, perhaps in the vicinity of hot springs,

mudpots, steaming fissures or even volcanic heat vents. One of the fundamental requisites of such sites is that they be free from excessive disturbance and exploitation, and the steady encroachment of growing human populations is rapidly eliminating many, if not most, of such sites. As these species do not have to tend and regulate a mound, they are theoretically able to forage over much larger areas, and so would not require the same sort of concentrated area of optimum feeding habitat as the mound-builders. On the other hand, the extent of suitable breeding habitat available to these species is a good deal more limited, so birds often congregate in large numbers to lay at the best sites, with the result that there are greater densities in the surrounding forest and more intense pressure from foraging competition than in the mound-building species. In this sense, it may be relevant that the Polynesian Scrubfowl, a burrow-nester, is one of those species suspected of holding feeding territories.

The Malleefowl differs from all other megapodes in that it inhabits semi-arid areas of mallee shrubland and woodland, which are dominated in particular by dwarf *Eucalyptus*, as well as other plants including *Acacia*. As this species lives and breeds further south than other megapodes, in cooler, drier, more open areas, the temperature and moisture regimes of its mounds are rather different too, as are the associated maintenance activities (see Breeding). The male in particular is tied extremely closely to his mound for up to eleven months of the year, so a rich and reliable food supply is essential to the success of the lengthy breeding attempt. Areas of optimum habitat for the Malleefowl have been seriously damaged and fragmented, and they are now few and far between; this constitutes the major threat facing this species at present.

In some areas, particularly in New Guinea, where several species are sympatric, there is often a degree of altitudinal segregation. This seems to be the case of the three species of the genus *Talegalla*. The Black-billed Brush-turkey occupies the lowlands of southern New Guinea. In the west it overlaps with the Red-billed Brush-turkey (*Talegalla cuvieri*) over a front of at least some 240 km, while in the east there is a similar zone of sympatry with the Brown-collared Brush-turkey (*Talegalla jobiensis*) covering a distance of 80-400 km. In both of these zones it appears that the Black-billed Brush-turkey is the lowland species, while its two congeners are forced uphill by competition. In contrast, where both of these species occur unaccompanied by the Black-billed Brush-turkey, they occupy areas of suitable habitat down to sea-level.

Nevertheless, in most parts of New Guinea, three different species of megapode can frequently be found in the same forests, with the occurrence of the Wattled Brush-turkey and a representative of each of the genera *Talegalla* and *Megapodius*. Indeed, an active nest mound of a scrubfowl species, probably the Orange-footed, was found within 200 m of an active mound of the Black-billed Brush-turkey. In the Southern Highlands of New Guinea, eggs belonging to each of these three genera were collected in the same area, including some eggs of both *Talegalla* and *Megapodius* from the same mound, probably indicating parasitic laying by the smaller scrubfowl (see Breeding). To date, so little is known about the ecology and the exact distribution of the species involved that it is impossible to assess the extent of competition that occurs between them, or possible segregating mechanisms.

The family is confined to the tropics, except in Australia, where the Australian Brush-turkey occurs south into temperate zone, and the Malleefowl occurs exclusively in this zone. Due to their unique incubation systems relying on asomatic heat sources, it seems highly unlikely that the mound-building members of the family could occur much further south, and this system is thought to have been the original method in megapodes, from which the uses of solar and volcanic heat are derived (see Breeding). Also, in the same way that latitude is a limiting factor, there are presumably altitudinal limits, above which the heat necessary for incubation can not be derived from decomposition; this fits in with a tendency of most species to occur, or at any rate breed, primarily in lowlands, although the Wattled Brush-turkey inhabits montane forest up to 2800 metres.

The Wattled Brush-turkey is one of many megapode species about which very little is known. This is partly due to the fact that its habitat is often rather remote, in the montane forest of New Guinea. Much of what is known about the species comes from a study of captive birds, but this is one of the few individuals to have been observed in some detail in the wild. Here, on his mound, this male is performing a curious display, in which he tucks his tail round under a wing, with the result that he appears to have lost it!

[*Aepypodius arfakianus*
arfakianus, New Guinea.
Photo: Brian J. Coates]



The reasons why the family has not spread any further north or west are surely quite different. Megapodes occur north to the Philippines and the Marianas, and west through most of the Lesser Sundas to the Kangean Archipelago, off north-east Java. They are not found in Java or Sumatra, and in Borneo occur only at the extreme northern tip; indeed, there is no evidence to suggest that they ever had more than this tiny foothold in the Greater Sundas. However, there is an isolated population in the Nicobar Islands (see Relationship with Man).

There are two main theories as to the causes of this pattern of distribution. The first suggests that the megapodes have been kept from colonizing south-east Asia and most of the Greater Sundas due to competition with their ecologically similar relatives the Phasianidae. That family occurs very sparingly east and south of the Greater Sundas, and of the few species that have reached New Guinea and Australia there are no forest dwellers. It is proposed that the Phasianidae, with their very limited ability to cross over water, have not been able to spread beyond the edge of the Sunda Shelf, which marks the limit of the land-bridge that formerly linked the Greater Sundas to south-east Asia.

An alternative view put forward remarks on the well delimited, and almost complete, allopatry of megapodes and potential mammalian predators. Such predators occur throughout the Greater Sundas, but are absent from the Nicobars, the Lesser Sundas, except Bali (where megapodes do not occur), the Moluccas and New Guinea. What is even more notable is that in the areas of overlap, at the extreme north of Borneo, in parts of the Philippines and in Sulawesi, all megapodes are burrow-nesters, rather than mound-builders. It is convincingly suggested that burrow-nesters are probably less susceptible to predation than are mound-builders, due to the much less frequent, and often shorter, visits to the nesting site, and also due to their communal nesting (see Breeding), which through sheer numbers increases the chances of detecting any approaching predator. Remarkable support for the proposal is to be found in the tiny Kangean Archipelago, where the Orange-footed Scrubfowl builds mounds on several of the smaller islands, but is absent from the main island, precisely where leopards and civets occur.

General Habits

Little is known about the habits of most megapode species when they are away from their breeding sites. They tend to be inconspicuous and rather shy, so they are usually difficult to observe.

Scrubfowl go about in pairs most of the time, and it has been suggested that lone individuals may more often than not be immature birds. In the case of the Orange-footed Scrubfowl, pairs have been found to hold territories, which may be defended against intruders. These territories can, but need not, contain an incubation mound. However, they do not appear to be related to breeding rights, as the female of one pair can lay in a mound that is in the territory of another pair. Thus, if there is enough suitable feeding habitat, the same mound can be used by two separate established pairs.

Research on the Polynesian Scrubfowl suggests that it may use a similar territorial system, although as yet hard evidence is lacking. This species lays its eggs in volcanically heated sites, for instance on exposed slopes of loose ash. Birds seem to spend the vast majority of their time foraging in forest or thickets and only visit these incubation sites for the purpose of laying, with the result that territories again appear to be independent of laying sites. In this species, as perhaps in others, food is thought to be a limiting factor, and it would thus seem quite plausible that each pair defends its own feeding territory. Apparently a pair advertises its ownership of a territory by means of a whistled duet, to which neighbours promptly reply. Neighbouring pairs that intrude are driven from the territory by the male: generally there is a short chase, after which the pairs call at each other repeatedly for five to ten minutes, until peace is once again restored. The size of these presumed territories was calculated in two areas to be in the region of 1-1.5 ha. An interesting possible corroboration is the fact that the female on her way to or from laying sites sometimes emits a soft bubbling trill, which may be a form of appeasement call to the owners of the territories that she is passing through.

Malleefowl tend to be solitary for about nine months of the year, when involved in breeding (see Breeding), and, although the pair-bond is strong, male and female tend to forage and roost apart, coming together only at the mound for nest main-



The Maleo, endemic to Sulawesi, is a burrow-nester that typically uses large communal laying grounds, often on beaches. Where a site suffers a certain amount of disturbance, the birds tend to arrive and lay their eggs only around dusk or dawn or at night. Large numbers of Maleos may gather in the vicinity of the laying grounds in the late afternoon, where they will wait in the trees, calling repeatedly, until they feel confident enough to emerge into the open. It is only in and around the laying grounds that the birds are at all conspicuous.

[*Macrocephalon maleo*, Sulawesi.
Photo: A. Greensmith/
Ardea]

tenance, copulation and egg-laying. However, once breeding is over, and during the short respite in late autumn, before the next breeding attempt is undertaken, several pairs may be encountered foraging together.

The Australian Brush-turkey is now one of the best known species, largely as a result of the extensive research carried out by D. N. Jones in recent years in south-east Queensland. This species tends to be solitary in most of its activities, for instance when foraging, but at artificially provided feeding sites, especially rubbish dumps, loose flocks of up to 22 birds sometimes congregate, and some shows of aggression may occur, although these groups are normally dissolved within a few minutes.

Males of this species are strongly territorial, defending their mounds by means of a progression of increasingly aggressive displays. These may start with a short charge at the intruder with the neck raised, and sometimes with the wings spread open. If the contest continues, the aggressor is likely to start booming (see Voice), and the fight often continues with a chase up into the trees. Another high intensity interaction is the Cock-fight, which recalls the typical battles of domestic or trained fighting cocks, the birds leaping at each other and striking out with their powerful feet. Such disputes are of considerable importance, as a male may see his mound, built with many hours of hard labour, usurped by another during a brief interaction.

Australian Brush-turkeys form communal roosts, with as many as 15-30 birds gathering in tall trees at the principal roosting site in the area. Other, smaller roosts may also be formed on a regular basis, but most of the mound-owning males in the area collect at the main roost. There are also regular sites used by several birds for resting during the day, but mound-owning males invariably stay close to their mounds for such day-time resting.

Several other species are also known to form communal roosts, at least during part of the year. For example, a roost of Brown-collared Brush-turkeys was located about eight metres up in a large forest tree. The copious droppings on the ground below suggested that this was a regular roosting site.

However, despite such communal roosting, it seems that megapodes generally seem to lead a fairly solitary life. Very little is known about the New Guinean genera *Aepyodius* and *Talegalla*, but the Wattled and Black-billed Brush-turkeys are usually found alone or in pairs. Equally unknown in many respects are the Wallacean genera *Eulipoa* and *Macrocephalon*, but, being communal burrow-nesters, both are amongst those species that do show some gregarious tendencies, as they can gather in very large numbers at particularly favoured laying grounds.

Some species, for instance the Nicobar and Orange-footed Scrubfowl, are reported to be partially nocturnal in their activity, and this is certainly the case again of some burrow-nesters, such as the Moluccan Scrubfowl, which come down out of the forest at night to lay their eggs, when they are less liable to be detected by potential predators, both of their eggs and of themselves.

In situations of alarm, birds very often walk or run off to safety, but they sometimes fly up fairly high into trees to take shelter; the frequency of these different responses varies with the species and the intensity of the threat. For example, the Vanuatu Scrubfowl (*Megapodius layardi*) and the Sula Scrubfowl (*Megapodius bernsteinii*) are both said to be loath to fly; if pressed, they will take flight, but after covering a short distance they quickly drop back into cover. When the Orange-footed Scrubfowl suspects danger, it bobs its head and outstretched neck up and down, sometimes freezing momentarily with its head held straight out in front of its body, as it attempts to locate the source of danger. The Black-billed Brush-turkey normally walks about with its tail held high, but when alarmed or suspicious, it often lowers the tail.

Amongst the most typical predators of megapodes are monitor lizards (*Varanus*), which habitually raid the incubation mounds to pilfer eggs. In an area of dry sclerophyll woodland in southern Queensland, individual feeding Australian Brush-turkeys have on several occasions been seen to repel lace monitors (*Varanus varius*) by turning their backs on them and showering them with a barrage of sticks and stones

and general debris, one of the few recorded cases of the use of weapons by animals; one bird was even seen to peck at the tail of a retreating monitor. However, on the small Indonesian island of Komodo, there is little Orange-footed Scrubfowl can do against Komodo dragons (*Varanus komodoensis*), which on occasions grow as large as three metres long. Nevertheless, on one occasion when a dragon was seen digging its way into a scrubfowl mound, a scrubfowl was just as quickly hurling the material back onto the mound; eventually the lizard gave up and moved off.

Dusting has been recorded in the Australian Brush-turkey, in one of the drier parts of its range. Birds go to regularly used sites, where pits have been formed, and squat in these while beating their wings to throw sand and dust over the plumage, in order to help clean it. In the same area birds, almost invariably females, have been recorded sunbathing, which normally involves rolling over onto one side, raising the respective wing and sometimes fanning the tail. Once again, the main purpose of such behaviour is likely to be feather maintenance.

Voice

Like many other largely terrestrial birds, megapodes are generally rather difficult to see, presumably an adaptation to the fact that on the ground birds are more open to attack from a wider array of potential predators. To overcome the communication problems arising from such secretive behaviour, they are fairly vocal.

Several species of scrubfowl tend to call noisily and continually when foraging. This is presumably a sort of contact call, which will act to maintain the pair in contact, although it may also have a series of territorial uses and implications, for example in the Polynesian Scrubfowl (see General Habits).

The Orange-footed Scrubfowl is reported to be rather less noisy most of the time, although when approaching the borderline with the territory of another pair, birds tend to call rather incessantly. Territorial advertising calls, which can be heard up

to six kilometres away in suitable conditions, involve the male and female occupying a favoured perch in a tree usually overlooking a creek. From this perch they perform a duet. This is emitted mainly at night, and mainly during the breeding season, but can, in fact, be heard at any time of day or in any season. During breeding, the duet is normally initiated by the female, but at other times of year it is the male that tends to start, and in the early part of the year he usually calls alone. To date, the Nicobar Scrubfowl is the only scrubfowl species for which there is evidence to suggest that it does not have a duet.

Black-billed Brush-turkeys mainly seem to call when approaching their mounds and mostly in the middle of the day, but they may call at any time of day or even at night. Partners can call simultaneously, but not apparently in a formalized duet.

Voice plays an important part in supplementing territorial behaviour and defence. For instance the Australian Brush-turkey is generally rather silent, but it uses a kind of deep resonant booming for warding off and driving off other males that may attempt to usurp their mounds and copulate with females that are already bespoken (see General Habits). A bird booms with its neck tilted downwards and its throat and pouch inflated; booming can only be performed properly by a male with a sufficiently developed throat sac, and as it is poorly developed in immatures this puts them at an even greater disadvantage in confrontations. The polygamous mating system of this species may be responsible for the fact that it performs no duet. The Malleefowl too proclaims its mound ownership by means of booming, although it lacks the bare inflatable throat pouch.

The burrow-nesting Maleo utters quite different vocalizations, which serve its own particular needs. For instance, when birds gather near laying grounds, they make a series of disyllabic rolls, which are thought to act as a form of contact call. Once the birds move out onto the beach and start digging their burrows, the frequent disputes regarding burrow rights are continuously accompanied by calls, including a duck-like quacking.

The main foraging method of the megapodes involves raking around in the leaf litter, typically for invertebrates or fallen fruits. Surprisingly little is known about megapode feeding habits, and this is even true of the Australian Brush-turkey, a species that has been the object of intensive research in recent years. Note the distended pouch and the outsize legs and feet.

[*Alectura lathami lathami*,
Conway National Park,
Queensland, Australia.
Photo: Oriol Alamany]



Food and Feeding

Surprisingly little is known about the diet of even the best known megapodes, while virtually nothing at all has ever been recorded for a good number of the species. However, it seems likely that in general terms both food and feeding habits will be fairly similar for most species.

The few species studied so far have been found to be omnivorous. The Malleefowl, the best known species in terms of feeding habits, but the least typical megapode in most respects, seems to be extensively granivorous. In this species the foraging strategy may be designed essentially for taking seeds, and the capture of small animals may be largely incidental. Observations of birds feeding showed that plant matter was taken in 87% of the cases recorded, while insects were recorded in only 13%. Indeed, even during periods when invertebrates form the bulk of the diet, the Malleefowl does not seem to seek out such prey actively, but rather takes more of them because they are more abundant at these times.

In contrast to these tendencies observed in the Malleefowl, both the Polynesian and the Sula Scrubfowl are considered to feed mostly on animal food. Both seem to be largely insectivorous, but the former has also been found to take considerable numbers of snails, as well as centipedes and worms. During extensive observations, this species was not conclusively recorded taking plant food: it was seen pecking at fruit, but might have been extracting insects.

A wide variety of different kinds of plant and animal have been recorded for the various members of the family. The commonest plant parts in the diet are seeds, buds, flowers, leaves and fruits, and many species feed on fruits that have fallen to the forest floor. Animal food recorded is very diverse, ranging from a whole host of insects to spiders, centipedes, worms, snails, perhaps small lizards and even dead rats. The Malleefowl even feeds on fungi.

The feeding habits of the Malleefowl first received serious attention during a pioneer study of the species carried out by H. J. Frith in the 1950's, in western New South Wales. He showed that this species has different food preferences at the different times of year: for instance, insects are taken mainly in spring; herbs in autumn, winter and spring; buds in winter and spring; flowers in spring and early summer; and seeds in summer and autumn; amongst plant food, the buds and fruits of *Beyeria opaca* are particularly important in spring and summer. The main food of the species has been summarized as seeds of legumes in summer, but herbs in autumn and winter. Several further studies have been carried out more recently, and these show a certain amount of regional variation, probably due to local availability, with for instance the greater importance of insects, especially lerps (Homoptera), in Victoria.

In some species, perhaps all, young chicks probably start off by feeding mostly on invertebrates, which they can take even on the day of hatching. Later, the young of several species may progress gradually onto a more herbivorous diet. Animal food is more easily assimilable and contains more nutrition, and this may well be important for the chicks. As they hatch considerably larger than the chicks of other birds of comparable size, and as they receive no help from their parents either in terms of food provision or at least the learning of foraging techniques, they may well have great difficulty finding sufficient food, and starvation has been found to be a major cause of chick mortality in the Malleefowl (see Breeding). Perhaps the chicks are poorly prepared for finding or recognizing suitable plant food, and they learn to take moving food items more quickly.

All megapode species typically forage by walking along, pecking at plants or scratching in amongst the leaf litter and soil with their feet, sometimes throwing aside a clawful of litter. When food is revealed, the bird can peck at it immediately, without having to step back first, in the typical manner of farmyard hens. As megapodes wander along scraping up the leaf litter and soil, the overturned material can provide opportunities for other species: For instance, the Australian Fernwren (*Crateroscelis gutturalis*) has been recorded feeding in association with the Orange-footed Scrubfowl.

Scrubfowl normally forage in pairs. For instance, in the Polynesian Scrubfowl the two birds almost always remain within 2-3 metres of one another, thus furnishing additional evidence that the pair-bond is very strong in this species, as it may be in other scrubfowl. An interesting practice has been noted in this species which has not yet been recorded in any other megapode. On locating food, the male frequently offers it to the female, by pointing at it with his bill, often calling her over by means of a soft piping. In cases where the food item is quite fast-moving, he will catch it in his bill and offer it to her. This food offering was recorded more than 20 times in half an hour, and in over 60% of prolonged observations of feeding. It has been interpreted that this behaviour may show that food is in short supply for the species, and that the female requires as much nourishment as possible to help in the costly process of egg formation.

Australian Brush-turkeys normally start foraging as soon as they leave the roost early in the morning, and they continue to do so right through till the evening, except for a period of repose in the middle of the day. However, when breeding, males tend to stay at their mounds in the early morning, as this is the period when most females visit mounds; during the breeding season, males normally start foraging only after about 08:00 hours.

An interesting relationship is that of the Australian Brush-turkey with the prickly pear (*Opuntia*). A bird will fly over this plant and snatch off a fruit with its feet, before landing rather clumsily beyond and consuming the fruit. At the beginning of the twentieth century, the prickly pear underwent a fairly short-lived population explosion in south Queensland and north New South Wales, and this was accompanied by a parallel expansion of the brush-turkey, as it was able to occupy habitat that was not normally suitable for it. The spread of the plant reached infestation levels and the angry farmers blamed the bird for causing the spread. However, it was found that the vast majority of the seeds were actually crushed in the bird's gizzard, and those that were not registered poor germination potential. In any case, the prickly pear was subsequently brought under control and the brush-turkey disappeared once again from the temporarily colonized zones.

Like many other birds, megapodes ingest grit in order to help break down their food. For instance, the Wattled Brush-turkey swallows pebbles, while the Malleefowl takes in large quantities of sand. No species is known to require water, but drinking has been recorded occasionally in species such as the Black-billed Brush-turkey and the Malleefowl. However, even during dry periods the Orange-footed Scrubfowl appears totally uninterested in water, and it will simply ignore any pools it comes across.

Breeding

The vast majority of what is known about megapodes is related to breeding. There are two main reasons for this. First, the fact that they do not use body heat for the incubation of their eggs is a habit unique within the bird world, and as such is naturally the aspect that has most interested scientists, from physiologists and biochemists to evolutionary biologists, taxonomists and biogeographers. Second, like many other Galliformes, they are essentially rather secretive birds, and it is only at their nest mounds or colonial laying beaches that they can be observed with relative ease and a certain degree of regularity. Nevertheless, although there has been an upsurge in interest in the Megapodiidae over the last decade or so, the habits of most species remain little known, or in the case of Bruijn's Brush-turkey totally unknown. Logically, it is the three Australian species that have received fullest attention, but other species too, such as the Maleo, have also been the objects of extensive research.

Much the most remarkable aspect of the megapodes' breeding strategy is the variety of unique incubation systems that they use. As many as five different systems can be distinguished, and the two basic modes of building mounds or digging burrows may be used as significant factors in clas-

There are very few records of megapodes drinking, and most species probably do so only rarely, if ever, instead obtaining their liquid requirements from their food. During dry spells the Black-billed Brush-turkey occasionally comes to drink at small pools in the forest, as illustrated by this bird, which was photographed in southern New Guinea. The brown patch on the hindneck shows that it is an immature.

[*Talegalla fuscirostris*, southern New Guinea. Photo: Brian J. Coates]



sifying the different groups, especially with relation to other particular features, such as foot structure or percentage yolk content of the egg.

The five identified systems are as follows: mound-building; burrow-nesting, using geothermal sites; burrow-nesting, using solar-heated beaches; burrow-nesting, using decaying tree-roots; and mound parasitism. As all three of the Australian species are mound-builders, this is much the best studied of the strategies. With the much more active participation of the birds in the preparation of the laying site, this system probably offers the greatest scope for research.

The megapode mound is one of the most remarkable constructions built by any bird, and while it may lack the architectural complexity of the nests of weavers (Ploceidae), penduline tits (Remizidae) and New World orioles (Icteridae), it makes up for this in sheer volume. The Australian Brush-turkey's mound averages almost one metre high, and three or four metres in diameter, containing an average of 2-4 tonnes of material. Indeed, the mounds on Kangaroo Island, off Victoria, contained a remarkable 6-8 tonnes on average. Admittedly, this population is not typical, as it arose from birds introduced on this island, well to the south of the present natural range of the species, in a zone where ambient temperature is correspondingly cooler, so more material is presumably required for the mound to reach the required temperature for incubation. Not surprisingly, such large agglomerations, requiring so much hard work in construction, may be used repeatedly over the years, and thus continue to grow; this happens regularly in the Orange-footed Scrubfowl, though not necessarily by the same pair, but much less frequently in the Australian Brush-turkey. One of the most impressive mounds on record, belonging to this scrubfowl species, was found in Northern Territory, Australia. It was a total of 18 metres long, five metres wide and three metres high; not surprisingly, it was active only at one end. Another mound of the same species was reported to be some eight metres in height, and another was 51 metres in circumference. Some of these largest mounds almost certainly contain well in excess of 100 m³ of material, probably weighing well over 50 tonnes.

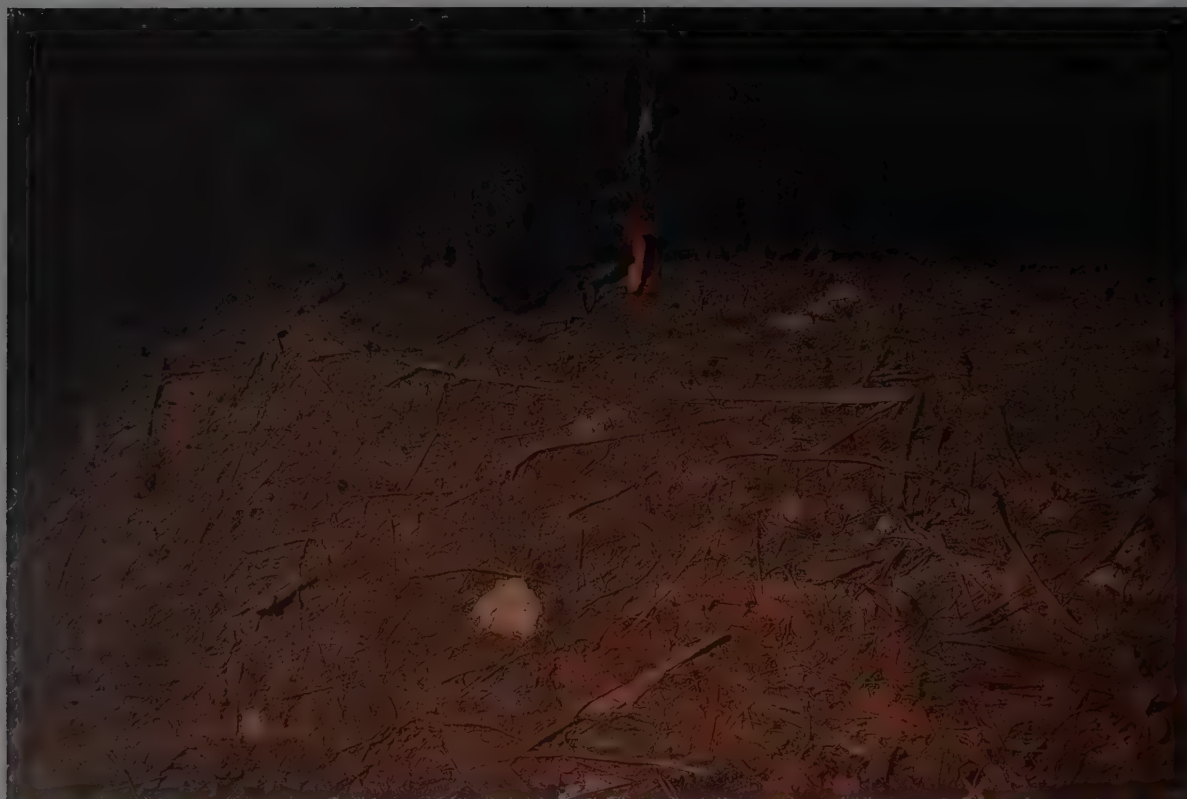
In terms of both volume and surface area, there is a minimum size limit at which a mound is viable for incubation.

Experiments using artificial mounds have shown that a mound needs to be at least 0.75 metres high and two metres wide in order to be able to generate the necessary heat, and observations in the wild corroborate this. However, size alone is obviously not the only factor, and mounds being reused need sufficient fresh material to permit adequate heat production.

Mounds are mostly conical, bell-shaped or sometimes elongated, in the case of some older mounds; those of the genus *Talegalla* tend to be lower, flatter and more irregular and untidy than those of *Megapodius*. Mounds are basically composed of any form of leaf litter, twigs, sticks and even branches, mixed with soil or sand, depending on the local substrate. Where sand is available it tends to be incorporated in fairly sizeable quantities, notably by the Malleefowl, but where heavy soil underlies the site it is far more sparingly used, as its capacity for conducting heat is far lower.

It was traditionally thought that the heat was caused by fermentation, but recent research has demonstrated that the heat is actually generated by the respiration of micro-organisms, in particular of thermophilic fungi. Both heat and oxygen percolate throughout the mound by means of diffusion.

The temperature of the mound is remarkably constant, especially that of the section in which the eggs are laid. Thus, throughout a breeding season often lasting 7-8 months, the Australian Brush-turkey's mound remains within a very tight range of 30.8°-35.8°C without constant regulation. A similar range of 29°-38°C is found in the Malleefowl, where the temperature is actively regulated by the male every day throughout the very long breeding season. The average temperature of the mound is also surprisingly constant between the different species. For instance, both the Australian Brush-turkey and the Malleefowl remarkably show exactly the same average of 33.3°C. The mound must reach a situation of temperature equilibrium, whereby any rise or drop in the temperature for whatever reason is automatically offset by an increase or decrease in heat loss. Three features particularly enhance the temperature stability of the mound: larger mound size; higher ambient temperature; and fresher constituent material. The temperature in the core of the mound is even more constant, and in one Australian Brush-turkey mound on Kangaroo Island, where the species is introduced south of the natural distribution



Megapode mounds can reach enormous proportions. The male Australian Brush-turkey builds his mound in an average of about 37 days, raking in all the suitable material from round about, and shifting some 56 kg per day during the early stages. Material typically includes soil, leaves, twigs, sticks and even branches. Throughout the breeding season fresh material may be added, so that the mound is constantly growing. The largest mounds of this species can contain about 4 t or even 6-8 t of material.

[*Alectura lathami lathami*, Queensland, Australia. Photo: Oriol Alamany]

of the family, core temperature was found to remain at 35.5°C, even when the mound was abandoned for at least six months over the winter. As overall temperature change is normally very slow in the Australian Brush-turkey's mounds, it can be tested and regulated by the addition of extra material or by airing each time a female comes to lay, when the mound has to be opened up anyway.

The physiological characteristics of the mound are of considerable interest. It is essential that the embryo, subsequently the chick, does not suffocate, so efficient gas exchange must occur throughout the mound. Equally, the egg must not become excessively dried out, as dehydration rapidly leads to embryo death, so the moisture content of the mound must also be just right. Too much water can also be a major problem, as waterlogging of the mound quickly leads to anaerobic conditions, and even more immediately to important heat loss. Furthermore, extra moisture leads to a higher rate of heat production, with the possibility of overheating, but, while this may be balanced by greater heat loss, in the long run the higher rate of energy expenditure by the mound means that the mound owner has to put in far more time providing the necessary material to fuel the whole process, while the overall condition of the mound is far less stable. Thus, the most efficient manner involves minimum heat production with correspondingly low heat loss, at the same time safeguarding an adequate supply of both oxygen and moisture for the embryos.

The importance of the correct moisture content has been clearly demonstrated during droughts, which can cause mass mortality. Experiments have shown that, in such circumstances, hatching success can be improved markedly, if a little water is added to the mound. At the other extreme, unusually long periods of persistent heavy rain can lead to the mound becoming waterlogged. If this happens, the eggs are doomed, due to the combined effects of excessive cooling and lack of air; any embryos may effectively be suffocated or even drowned, if they have not already perished due to the cold.

Usually most of the construction and maintenance work devolves on the male, and in the polygamous Australian Brush-turkey, for instance, the female plays no part at all. This is an integral part of the whole megapode breeding strategy, as the female's production of a large number of very large, high

quality eggs means that she must devote herself uninterruptedly to the business of building up the energy necessary for the formation of these eggs. The Australian Brush-turkey builds its mound by scraping together plant litter and soil at the chosen site. This tends to involve 5-7 hours a day over some 36 days, before the mound can be considered more or less functional. While males of this species often own more than one mound, at the other extreme several pairs of Orange-footed Scrubfowl can lay in the one mound, although this species too frequently holds subsidiary mounds.

Mounds usually require substantial attention from their owners, mainly in order to maintain the temperature equilibrium. Birds will add some moist material if the temperature requires a boost, or alternatively they may open up the mound if it is becoming too hot. The addition of just a small amount of material to the mound can increase the core temperature of the mound quite considerably. Overheating is as dangerous as overcooling, and would ultimately lead to the death of the embryos. It is thought that if gas diffusion deteriorates notably in the mound, the Australian Brush-turkey, at any rate, may dig ventilation holes in an attempt to combat this problem. Daily attention of the mound also serves to prevent the material becoming too compacted, reducing aeration and heat production, and also making it more difficult later on for chicks to extract themselves from the mound.

However, in the Malleefowl the process is a good deal more complicated. This species builds a mound that is in many respects not dissimilar to those of other megapodes, but the heat necessary for incubation comes from two different sources: that produced in connection with the process of decomposition; and that coming from the sun's rays. This is connected with it being the only species adapted to living in fairly open areas, and is also probably related to its more southerly distribution. The construction of the Malleefowl's mound starts in early winter with the digging of a pit, roughly three metres wide by one metre deep, the excavated sand or soil being heaped up round the edge. The male and, to a lesser extent, the female gather together all the plant litter from round about, raking it into this pit with their feet until the heap rises about 60 cm above ground level, and then leaving it to receive a good soaking from the late winter rains. After this, in the top of the pile a small egg



The fact that the Malleefowl inhabits much more arid, open habitat than other megapodes, at a more southerly latitude, means that the processes involved in the operation of the mound as an artificial incubator are somewhat different. It is the only species that combines the use of heat produced in connection with the fermentation of plant matter and that provided by the sun's rays.

[*Leipoa ocellata*,
Victoria, Australia.
Photo: Des & Jen Bartlett/
Survival]

chamber is dug, in which only the more delicate material is retained, such as leaves and bark, but not large sticks. The whole heap of plant matter, now beginning to rot, is stirred and then covered over with sand or soil, which forms an insulating layer to keep in the heat and also permit the draining off of excess moisture. The birds now regularly monitor the mound temperature, and once it reaches the required temperature of about 30°C, egg-laying can begin.

Now that the female must concentrate on building up the extensive resources necessary for egg formation, the male is on his own. Every day throughout many months he laboriously tends and manipulates his mound, controlling both temperature and moisture as much as possible, but the processes vary across the seasons. At the start of his long vigil, the weather is generally fairly cool, so that most of the heat is microbially produced, and in the morning he regularly opens up his mound in order to let the excess heat escape, quickly covering it with sand again, to avoid too much heat loss. As the season progresses, the sun becomes warmer, while microbial action diminishes, and the bird now has a brief respite during which slightly less maintenance activity is required.

However, as summer arrives the problem turns to the business of trying to avert excess solar heat, as fermentation has now lessened considerably. The mound is covered with a thick layer of sand so that the eggs do not overheat, and from time to time it may be opened up in the early morning to get rid of excess heat. Towards autumn, the effects of any fermentation are waning and the sun's rays are now much weaker. The male is now rejoined in his work by the female, and daily, around mid-morning when the day is warming up, the birds open up the mound to let the sun's warmth pervade it. Now they busy themselves in heaping up sun-warmed sand over the mound, so that by the late afternoon the eggs are once again covered by a thick layer of warm sand which will keep them warm throughout the chilly night. Eventually, even this strenuous labour is not sufficient to keep the mound temperature high enough, and the nest is abandoned for the year. Sometimes it is dug out by the male, and left as a bare crater, possibly to be used again in a forthcoming season; any eggs turned up in the process are kicked out with the rest of the mound material.

Thus, while it is often asserted that megapode chicks receive no parental care, this statement requires qualification. In fact, very few other male birds invest so much energy over such a long period, to ensure the successful development of their young. The parental care of mound-building megapodes can be considered to take place before the chick leaves its egg.

The case of the burrow-nesting species is really quite different. They use naturally occurring sources of heat, which can be divided into three main types. The first encompasses a variety of geothermal sources, involving heat produced by some sort of volcanic activity, and is related to the fact that the distribution of the megapodes coincides in part with the Ring of Fire and other zones influenced by intensive volcanic activity. For example, the Polynesian Scrubfowl, which is restricted to the island of Niuafo'ou, an active volcano in the Tonga group, typically lays in beaches alongside crater lakes or in slopes of volcanic ash, sometimes in the proximity of heat vents. The second source is solar energy, which some species are able to harness for their benefit, by laying their eggs in beaches, typically those of black sand which more readily soaks up the heat of the sun's rays. This is a widespread potential source of heat, but is actually used by relatively few species; indeed, there are many apparently suitable beaches available to the several species found in New Guinea, but as yet no evidence of the practice occurring any nearer than on the Admiralty Islands. The third source of heat is that created by the decay of rotting tree roots. This system remains very poorly known at present, but it may be the normal method for the Vanuatu Scrubfowl.

For most burrow-nesters scarcity of suitable nesting sites is usually a major limiting factor, so it is normal for these species to use communal laying grounds. These can vary from just three or four pairs laying at the same site to the colossal scale of nesting recorded in the Melanesian Scrubfowl, at Pokilli in New Britain, where tens of thousands of burrows can be found, and some 53,000 birds were estimated to have been present in 1978. The largest site known for species that use solar heat is one on the island of Haruku, to the south of Seram, where up to 4000-5000 pairs of the Moluccan Scrubfowl may lay throughout the year.



Maleos lay their eggs in burrows, often in communal laying grounds. These may be on solar-heated beaches or at sites where the ground is heated by geothermal activity. Where the substrate is firm, laying grounds tend to be covered in a series of craters. Inside one of these craters, the male and female join forces to dig a subsidiary burrow, and, once this is ready, the female disappears into the burrow to lay her egg. After a while, she emerges, and the pair fill in the burrow again before departing, taking no further interest in the egg.

[*Macrocephalon maleo*, Tengkok Reserve, North Sulawesi. Photo: Alain Compost/Bruce Coleman]

Where such sites are out in the open, many birds may congregate towards evening in the forest nearby, waiting for darkness to fall and keeping a look out for potential predators. If there is no sign of any disturbance, around dusk or dawn the birds may emerge onto their laying grounds and start digging. The exact timing of laying varies with the species, the site and the levels of disturbance that prevail there. Maleos, for example, can start digging in the late afternoon, although even then they probably wait until the next morning to lay. The Melanesian Scrubfowl tends to do all its work in the early morning. The habits of the Moluccan Scrubfowl are poorly known, but it apparently performs the whole process under the cover of darkness.

Large, communal laying grounds can present a sort of lunar landscape, as the whole area may be peppered with small craters. After selecting a suitable egg-laying crater, a bird will disappear into it, and then dig a subsidiary burrow in which it lays its egg. In the Maleo, both members of the pair take active part in digging the burrow, a process which can take from half an hour to as much as three hours. Then, after a long period during which the female is under the ground laying the egg, it may take them almost as long to fill the hole in again. In scrubfowl the business of digging the burrow takes much less time and is carried out by the female alone; if undisturbed, she will often rest for an hour or so in the main burrow after laying the egg. In the Vanuatu Scrubfowl burrows can be 120-300 cm deep, 40 cm wide and up to 200 cm long. Those of the Melanesian Scrubfowl average 40 cm wide by 90 cm long, while in the Polynesian Scrubfowl they are roughly 15-20 cm wide by about 90-150 cm long. On beaches the sand is obviously far less stable and quickly caves in, so that the effects of burrowing are rarely obvious long after the moment of laying. However, for the very same reason, the whole process of excavating a suitable hole is much harder work.

Like mound-builders, burrow-nesters also lay their eggs at sites with very regular temperatures, but they do not need to regulate the temperature, and, in fact, are unable to do so. Nevertheless, the limited evidence available to date suggests that they use sites where they have learnt by experience that the temperature remains fairly constant at the required level. Interestingly, the Maleo and the Polynesian Scrubfowl tend to

lay at sites showing rather similar temperatures to those recorded for the mounds of the Australian species. Once the egg has been laid, the subsidiary burrow is filled in again with whatever material is available, in some areas including fresh vegetation which may actually contribute to the heat in the way it does in mounds. After this stage has been completed, the egg is totally abandoned to its fate; thus it might be said that burrow-nesting megapodes are the only birds, apart from brood parasites, in which all parental care ceases immediately after the laying of the egg.

The case of those burrow-nesters that use rotting tree roots as their source of heat differs somewhat from the two main types. This form of burrow-nesting depends on microbial heat produced by the decaying roots of live trees, and in some ways it could almost be considered a form of mound-building that does not require any kind of construction or maintenance. On the other hand, the processes involved and the type of burrow made are entirely comparable with those used by other burrow-nesters. As a consequence of the reduced area available for laying, such sites do not seem to be used communally, or at any rate by a large number of pairs.

Mound parasitism remains the least known of the methods. In several of the few cases known, it is unclear which species are involved, and in some of these cases it is not even clear which species is parasitizing which. The Moluccan Scrubfowl, normally a burrow-nester, has often been suspected of laying in the mounds of other species, but, although it is not actually even known to build mounds, it too has been said to suffer parasitism by the Dusky Scrubfowl. It seems likely that a species of *Megapodius*, perhaps the New Guinea Scrubfowl (*Megapodius affinis*), parasitizes mounds of both the Wattled Brush-turkey and one of the *Talegalla* species, probably the Brown-collared Brush-turkey, in the southern highlands of New Guinea, where what is certain is that the eggs of two different species have been found in the same mound. This system again shows features of both of the major megapode incubation methods: incubation of the eggs logically proceeds in exactly the same manner as in the mound-builders; but the act of laying recalls the burrow-nesters, as the bird is essentially making use of an already existing heat source. Parasitism might well be derived from the practice, recorded in the Orange-footed Scrub-

fowl, of several pairs laying in the same mound, which might itself anyway be considered a form of mound parasitism.

The breeding season for megapodes is very variable, and, as in many tropical bird species, tends to be related to rainfall patterns. For instance, throughout its extensive range the Orange-footed Scrubfowl tends to avoid breeding during the rainy season, presumably to lessen the risk of its mounds becoming waterlogged. Several species, such as the Maleo, can be found breeding throughout the year. In contrast, in south-east Queensland the Australian Brush-turkey's nest building activity does not tend to get under way until the first heavy rains have arrived, in this case permitting the commencement of the fermentation process. The Malleefowl, with its more southerly distribution, can not raise sufficient heat for incubation during the winter, but its whole breeding process is so complex that it can last as much as eleven months of the year from beginning to end.

It was long assumed, for evolutionary reasons, that the remarkable investment of the male in mound-building species must imply that his parentage of the chicks is guaranteed, which in turn could only be the case in a system of monogamy. This is still thought to be the norm in most species, especially in scrubfowl. However, the Australian Brush-turkey is now known to follow a strategy of simultaneous polygyny, a male attempting to mate with each female that comes by his mound. It seems that the more time and energy he invests in building a larger, more attractive mound, or in building and maintaining two mounds, the more likely he is to be successful in attracting females with which to mate. In addition, recent research has shown that once a female has found a suitable male she tends to copulate only with him and lay only in his mound for about 3-6 weeks, thus adopting temporary monogamy; only occasionally does a temporarily paired female attempt to mate with another male.

Polygyny has also been recorded in the Malleefowl, where one male was found to own two mounds, each attended by a different female, but such cases are thought to be rather exceptional in this species. Although essentially monogamous, like the scrubfowl and the Maleo, the Malleefowl differs in that its strategy is based on defence of a mound and its immediate surroundings, whereas in the scrubfowl, the male appears to

defend his female and several pairs can lay in the same mound; in this respect, the Malleefowl's strategy is perhaps closer to that of the Australian Brush-turkey. The systems followed by the genera *Aepyptodus* and *Talegalla* are not yet known, but while certain aspects of breeding behaviour in captivity have linked the former with *Alectura*, the latter genus is tentatively grouped with the monogamous species.

Little or nothing is known of courtship, pair formation and most other basic aspects of breeding behaviour in the vast majority of species. Again it is apparently the least typical species that are the best known.

In the Australian Brush-turkey mate choice is made by the female. Throughout the breeding season, females wander about inspecting males and their mounds; this involves watching the male's behaviour at the mound and sometimes probing into the mound with the bill, taking a billful of material and manipulating it between the mandibles. As has been seen, a female apparently stays with one male for about 3-6 weeks, after which she moves on to another, fresher mound.

There are several factors that influence the female in making her decision, and one of these seems to be the ease with which she can dig into the mound: if the mound is not clogged up with large sticks and other awkward items, she can probably shift the material far more easily and quickly, with less risk of injury; equally, the same conditions probably favour her chicks when they hatch. Regular male attendance at the mound is another significant factor, as this is essential for successful hatching, and the lengthy incubation period may well be one of the reasons that females tend to choose mounds that have only recently reached suitable temperatures for incubation, as this implies that there is less danger of the male's interest in his mound ceasing before the chicks hatch.

When a female Australian Brush-turkey approaches a mound, the male presents her with a ritualized stalking display, in which he bobs his head up and down. Copulation takes place on top of the mound, and the male will not permit a female to lay in his mound, unless she first copulates with him. Egg-laying tends to last over 45 minutes, but sometimes takes less than 15 minutes, if other females are queuing up to lay. On occasions, females will squabble over the right to lay in a particularly good nest, and a waiting female may wander off.

Mound temperature tends to be surprisingly constant. This is essential for the correct development of the embryos, and too much or too little heat can result in the loss of all the eggs in the mound. The male Australian Brush-turkey efficiently regulates the temperature of his mound. If it becomes too hot, he will open vents to let the excess heat escape, whereas if it cools down excessively, he will add fresh material, and thus increase the rate of fermentation.

[*Alectura lathami lathami*,
Australia.
Photo: Kenneth W. Fink/
Ardea]



possibly to lay elsewhere. Mound ownership is absolutely indispensable for a male, as it is almost impossible for him to secure a copulation without a mound. For this reason, each male defends his mound or mounds vigorously against intruders and possible usurpers.

In all species, both mound-builders and burrow-nesters, the correct incubation temperature is essential for laying. A bird will "drill" test holes into the mound or burrow, in order to check that the temperature is suitable, and to find the right depth for laying, and in this process the bill or the mouth may be used as a thermometer (see Morphological Aspects). In the Malleefowl the eggs are laid in the central core area, but other mound-builders may lay more or less anywhere in the mound. Burrow-nesters sometimes find that a burrow they are in the process of digging does not meet the necessary requirements, because it is too cold, too wet or the walls too crumbly. In such cases, they will simply abandon that burrow and try again in another place.

One of the intrinsic features of the megapode breeding strategy is the prolonged period of fertility of the female. This is dictated by the high energy content of each egg, and is permitted by the lack of post-hatching chick care. One of its most obvious benefits is that, despite the high energy demands of each egg, the female can produce a large clutch, although in megapodes clutch size is normally difficult to ascertain. In captivity a female Australian Brush-turkey can lay 30 eggs over a period of several months, representing up to three times her own body weight. The Malleefowl normally lays a clutch of 15-24 eggs, whereas a female Maleo is reckoned to produce 8-12 eggs per year. At Garu, in New Britain, 20 burrows of the Melanesian Scrubfowl were taken as a sample and studied for six weeks, during which time production ranged from four to eleven eggs per burrow. However, the ratios of females per burrow, burrows per female or both were not known.

The egg itself constitutes yet another remarkable feature of megapode breeding. It is white in *Alectura* and *Aepyodius*, but in all the other genera the shell is covered in a reddish brown powder, a colour not known to occur on any other galliform eggs. It is fairly large, averaging approximately 75 x 45 mm in the Polynesian Scrubfowl to 106 x 62 mm in the Maleo, with average weights of 75 g and 231 g respectively. It generally represents roughly 10-20% of the female's body weight. However, of more significance is the extremely high yolk content. In most birds, including all other Galliformes, the yolk only very rarely constitutes as much as 50%, and in some species with notably altricial chicks, the proportion can be as little as 15%. However, there is a range of 48-55% for most brush-turkeys, 51-54% for *Leipoa*, and a remarkable 61-69% for *Macrocephalon* and *Megapodius*. The high values for these last two genera are paralleled only in the kiwis (Apterygidae), which, like megapodes, have a very long period of incubation.

The high yolk content is closely connected with the advanced stage of development at which the chick emerges from the egg. A direct result of this high yolk content is that the egg is much more elongated than in most other birds, as the yolk has to be more evenly distributed throughout the egg, rather than amassed at one end; the same is also true of reptile eggs. Another logical effect is that the initial water content is unusually low, making up an average of only about 67%, as opposed to 75% in other birds with precocial chicks and more than 84% in those with altricial chicks. The moisture content of the mound obviates the necessity of an extra water supply for the embryo, and water loss is very low, only 8% of the initial egg weight in the Australian Brush-turkey. This also means that the embryo makes the maximum use of all the energy supply of the egg in its growth and helps to advance its development; indeed, the Malleefowl embryo uses 94% more energy than do the embryos of other precocial chicks in similar-sized eggs.

The shell is very thin, measuring only 69% of the thickness expected for an egg of its size. This is a development that permits highly efficient gas exchange, so that although the egg is buried under the ground, sometimes in rather moist condi-

tions with a somewhat limited supply of oxygen, the embryo's air supply does not run out. As a result of this, the level of gas conductance of the Australian Brush-turkey's egg is more than double that of similar-sized eggs in other bird groups, which means that despite the extraordinary conditions of the egg being buried underground, the gas tension within the egg remains very close to that found in other birds' eggs.

The eggs of most birds have a small air chamber which is enlarged during the incubation period by water loss, and which provides the chick with air for its first breaths prior to hatching. However, this chamber is lacking in the megapode egg, as a result of the reduced water loss, so that the chick can not take its first breath until the shell has been broken, with the result that hatching is of necessity very rapid. Thus, instead of the normal hatching process of other birds, using the egg tooth, the megapode chick actually kicks its way out of the egg, rupturing the shell instantly, so that pulmonary respiration can begin at once; at the same time, in the moment of hatching a fair amount of water tends to be discharged from the egg. It is interesting to note that the chick does indeed grow an egg tooth during the embryo period, but loses it by the time of hatching. This is further proof that the megapode incubation system, along with the large egg, the thin shell and other features, almost certainly evolved from the typical system used by other birds, which was subsequently lost. The very thin shell again comes into play, as it facilitates the chick's rapid escape in this crucial moment. On the other hand, while undergoing incubation the egg does not generally require as thick a shell as in other birds' eggs, because there is only a limited chance of it being broken by the adults. Finally, another advantage of the thin eggshell is that it is energetically less costly for the female to produce.

The incubation period is very long, taking 71% longer in the Malleefowl than would be expected for eggs of such weight; this is directly related with the high yolk content of the egg and the highly precocial hatchling. The length of the incubation period itself varies remarkably depending on the physiological conditions of the mound. Indeed, in the Malleefowl it has been known to take as little as 50 days and as much as 96 days, probably the greatest range noted in any bird species; in different artificial conditions eggs of this species have even been hatched at 44 and 99 days. Another evident difference with the habits of other birds is that megapodes' eggs are not turned during incubation.

There is no synchronization whatsoever in hatching, which ties in with the lack of parental care, as there is no need for a brood to be cared for and raised together. Indeed, the fact that the different chicks hatch over a lengthy period would anyway make the task of parental care excessively burdensome. In line with this, chicks in captivity tend to shy off from one another or even use threat displays, rather than showing the gregarious habits of other galliform chicks.

The super-precocial chick remains in the egg as it effectively passes through the stages of the first days or even weeks after hatching of the chicks of other birds. In the first place, the chick is very large, again a direct result of the large yolk and the long incubation period. For instance, a Melanesian Scrubfowl chick that had just emerged from its nest burrow on the island of Savo, in the central Solomons, already measured 11 cm in overall length, roughly a third of adult length, and even more impressively it had a 31 cm wingspan, probably about half that of the adult.

On hatching, the chick struggles up to the surface, usually a journey of about 50 cm, which can take as little as a couple of hours or a full day, or more, and, not surprisingly, by the time it gets to the top it normally requires a rest. Clearly, in order to be capable of successfully completing such a journey, the chick needs to be in a very advanced stage already upon hatching.

The hatchling is the most precocial in all birds. It receives absolutely no parental care, and an adult Malleefowl that came across an emerging chick while tending its mound simply kicked it out as though it were another item of mound material. The chick lacks the usual coat of down, but instead already has



The Orange-footed Scrubfowl is much the best known member of *Megapodius*, due mainly to an interesting study carried out in Queensland in the early 1970's. In this species, mounds are regularly reused from one year to the next, although not necessarily by the same pair. An interesting discovery was that one mound can actually be used by two different pairs simultaneously, although the pairs remain strictly independent of one another, and are not to be seen together on the mound. Such sharing is perhaps all the more surprising, given that in this species each pair maintains a territory. The explanation is that the territories are probably related to foraging, as opposed to breeding, so, where food is sufficiently abundant, birds may allow their neighbours to use a mound that is on their property.

[*Megapodius reinwardt*.
Photo: Hans & Judy Beste/
Ardea]



The business of mound maintenance is especially arduous in the case of the Malleefowl, as the male, in particular, has to tend the mound assiduously for up to eleven months a year. The most complicated task is temperature regulation, particularly as the processes involved vary at different times of year. Nevertheless, most of the work involves removing and putting back material, especially sand. In order to shift the sand, the bird invariably faces away and scoops the sand backwards, whether it be onto the mound or off it.

[*Leipoa ocellata*, Australia. Photo: L. Robinson]

a fairly full plumage of pennaceous feathers, including all but the outermost two primaries; it is capable of flight almost straight away, in its first day of life. Indeed, a hatchling Melanesian Scrubfowl released by an egg-collector flew out over the sea and then back into forest, covering an estimated approximately 1600 metres non-stop. A newly-hatched chick is also immediately capable of regulating its own temperature within a range of at least 5°-45°C. In some species it begins to feed by itself at about one day old, normally after losing weight on its first day out of the egg.

One of the most interesting peculiarities of the megapode chick is the fact that it has no opportunity of imprinting on its parents, except very rarely in cases such as the described, when it might happen to emerge just in a moment when an adult is tending the mound or laying in a burrow. Thus, again as in the brood parasites, like cuckoos, species recognition must be innate in megapodes.

The little that is known about breeding success once again refers to the Australian species, but the pattern is likely to be similar in all species. A study of success rates in the Australian Brush-turkey over three years, involving 499 eggs, showed a high overall hatching success of almost 87%, although in one year, with a particularly wet spell that caused mound temperatures to drop by 8°-12°C, under 80% of the eggs hatched. In contrast, recruitment was very low, with 90-97% of the chicks failing to reach the subadult stage, giving an annual average of 0.8-1.7 chicks recruited per successful male. In this case it seems that much of this mortality was due to predation, mainly by cats, but probably also by dogs, dingos, snakes and raptors.

Elsewhere, predation of eggs, especially by monitor lizards but also by dingos and foxes, has been found to be a major cause of low overall success. In the 1950's, a study of hatching success in the Malleefowl in New South Wales found it to be about 50%, with 37% of the eggs taken by foxes. A study in

the same zone in the 1980's gave a similar overall result of about 50%, but in this case fox predation accounted for under 6% of the losses, whereas infertility of the eggs was the main cause of failure; it is thought that fragmentation of the population (see Status and Conservation) and resultant inbreeding may be responsible for this apparent decline in fertility, and significantly a simultaneous 1980's study in South Australia showed hatching success of over 79%.

An interesting experiment was carried out to test the survival rates of Malleefowl chicks in the absence of terrestrial predators. This involved distributing 29 artificially incubated chicks among four enclosures in natural mallee vegetation, each of which had slightly different conditions. The results showed convincingly that food availability was a major factor for chick survival, as all but one of the chicks that had access to extra food outlived the 30 days of the experiment, while not one of the birds in other enclosures survived. The fact that chicks have to learn feeding skills by themselves, instead of being taught by a parent, may well be a significant cause of mortality in all megapode species.

In looking back over the many extraordinary aspects of the megapode breeding system, it seems inevitable to ask how and why it all began. There has been much speculation as to which of the two main incubation strategies, mound-building or burrow-nesting, was the original method used by the early megapodes. On the evidence currently available, it seems that mound-building is more likely to have been the original method used, essentially as this would involve the fewest changes of habit along the way.

In effect, this would mean that somewhere along the line the Maleo's lineage lost the habit of mound-building and switched to burrow-nesting, while the scrubfowl gained the option of burrow-nesting. If burrow-nesting were taken to be the primitive method of the megapodes, this would mean that four whole genera would have to have lost the habit of bur-

row-nesting and have gained that of mound-building, while the condition of the scrubfowl remains the same. A third possibility is that both methods evolved simultaneously, but this seems highly unlikely, and would still imply that all genera except *Megapodius* had lost one or other of the traits. In the future it will be interesting to see if further taxonomic research bears out the conclusion that within the genus *Megapodius* strict mound-builders like the Nicobar Scrubfowl are more primitive, and strict burrow-nesters like the Polynesian Scrubfowl more advanced.

Evidence to support this proposal comes from the foot structure, as the Maleo's foot appears to be adapted for digging (see Morphological Aspects), while all scrubfowl, including burrow-nesters, lack this feature. If these burrow-nesting species lack this feature, it is more likely that the structure seen in the Maleo does not represent the original megapode foot, but rather a later development. Thus, the Maleo would be a more advanced species than the scrubfowl, while the brush-turkeys and perhaps the Malleefowl would be even older forms. The extremely high yolk content in the eggs of the Maleo and the scrubfowl would be a sign of the more advanced state of development of these species, rather than a relictual feature.

A further step in this analysis involves an attempt to establish which of the main burrowing strategies came first, those using solar or geothermal heat sources. While this too remains effectively a matter for speculation, it has been noted that of all the species known to use more than one system there is none that combines mound-building and nesting on sun-heated beaches; it seems that in order to adopt this strategy, a species may first have to pass through the practice of using geothermal heat.

Assuming that the incubation methods of the megapodes are not evidence of a direct link with the reptiles (see Systematics), then it must be supposed that at some stage the megapodes' ancestors incubated by means of body heat like all other birds. The mound-building habit may have evolved from incubating birds covering their eggs with leaves when they left the nest in order to keep them both warm and inconspicuous, a common practice for example in the tinamous (see Volume 1, page 120). Birds might have found that by placing more

material over the eggs, they could leave them for longer periods, and from here the step to mound-building would not appear too difficult.

Movements

The Galliformes in general show a rather limited capacity of mobility, and in the entire order true migration is limited to a handful of Old World quails (*Coturnix*). The results of this would appear to be reflected by the geographical distribution of the component families, which present a very limited degree of overlap. It seems that when members of the order occupied different zones, they were better able to diverge and adapt themselves locally to the conditions prevailing in the particular zone, rather than adopt the practice of moving back and forth between different zones to take advantage of the best moments in each. This may well be related to the fact that plants often make up an important part of the diet, and this requires relatively large body size, although this difficulty need not be unsurmountable, as notably demonstrated by some members of the Anatidae.

The megapodes are usually reckoned to be more mobile than most other Galliformes, but this epithet is really applicable only to the scrubfowl. The other species, comprising the much larger brush-turkeys, Malleefowl and Maleo, appear to be at least as poorly designed as some of the larger pheasants (Phasianidae) for movements of any great distance. However, at present very little is known at all about the movements performed by megapodes.

Some movements over water are known to occur, and these have particularly been noted on small islands where the birds quite certainly are not normally present, but where they may suddenly turn up to breed. The number of Moluccan Scrubfowl thought to breed on the small island of Haruku (see Relationship with Man) is so large that it must include at least some that fly the few kilometres separating this island from Seram to lay here, and birds have indeed been seen arriving over the sea soon after dusk. One of the most notable cases of such movements is that of the Micronesian Scrubfowl, as its island-hopping habits are particularly evident in parts of

The moisture content of the mound is just as important as the temperature, and must also be actively controlled. Too little moisture will dry out the eggs and may cause fermentation and heat production to cease. Too much moisture can lead to waterlogging of the mound, implying a slump in both gas exchange and temperature levels, and ultimately the loss of the eggs; this can, in fact, be a major cause of breeding failure in the Australian Brush-turkey.

[*Alectura lathami lathami*,
Australia.

Photo: Kenneth W. Fink/
Ardea]





The megapode chick is the most precocial in the bird world. It escapes from its egg by means of a sharp kick, rather than gradually pecking its way out, like other birds. It then works its way up through the soil, sticks and leaves to emerge on the surface of the mound, the moment captured in this photo. It is already all but fully feathered, and almost at once it is capable of flying, feeding itself, and regulating its own temperature. It receives no attention or assistance whatsoever from the adults.

[*Alectura lathamii*,
Australia.
Photo: Cyril Webster/
NH&A]

the Palau Islands, due to the very small size of many of the islands. On occasions, birds must be capable of flying several kilometres over water, and the very presence of this species in the Palau Islands and especially in the Marianas, quite some way from the nearest landmasses begs the question as to how they arrived. It seems mostly likely that this species and also the Polynesian Scrubfowl reached their current ranges by natural means, presumably by dispersal over the sea (see Relationship with Man).

Especially in colonial nesters, it has been suggested that birds may cover great distances between regular foraging grounds and the laying site. Certainly, some such mechanism must exist at any rate at the largest colonies, such as Pokilli in New Britain (see Relationship with Man), because the huge numbers of female that use these sites could not be supported by the forest immediately surrounding the laying sites, and to these numbers must be added the males. At this particular site, flocks of over 60 Melanesian Scrubfowl have been seen flying over the sea heading apparently towards what were, at the time of a study in the mid-1970's, vast expanses of undisturbed lowland forest; it was not known if the birds remained permanently in this nearby forest, or dispersed further afield.

The three Australian species are sedentary, and each Maleefowl pair maintains a home range of 1.7-4.6 km², which may overlap with that of its neighbours. It seems very likely that most species are basically sedentary, especially mound-builders, but juveniles may regularly disperse over quite large areas. Radio-tracking has occasionally been used, although with mixed success. For instance, of six Maleos so equipped, five almost immediately disappeared from the laying site without further trace, while the other stayed around the site for 12 days. A female of this same species, wing-tagged at a laying site, was resighted five years later, some 25 km from where it was originally marked.

Relationship with Man

Like most Galliformes, megapodes have a long history of contact with the local human populations, and at various different times humans have almost certainly had important influences

on the distribution of several species, although the true extent of this may never be known.

The current distribution of the Megapodiidae has been a fertile source of speculation and discussion. The present geographical limits of the family have been explained by different hypotheses (see Habitat), but there are two populations that stand out particularly, namely the tiny isolated outposts in Tonga in the east and the Nicobars in the west, both of them separated from any other megapode populations by vast stretches of sea, and distances in excess of 1500 km and 2500 km respectively.

One possible explanation that has commonly been quoted is that the birds were transported to these islands by humans. For the eastern population, this might have been at the hands of early colonizers on their migrations into the South Pacific. Against this proposal of human transport is the fact that there is no evidence to show that any megapode species has ever been domesticated. Several species have now been found to breed well in captivity, which suggests that domestication might be feasible, but any successful domestication would surely have been very likely to lead to the rapid proliferation and spread of domestic birds, as happened with some other galliform species, most notably the junglefowl (see page 463).

However, much stronger contrary evidence is available in the case of the Polynesian Scrubfowl, a species that is found only on the small Tongan island of Niuafo'ou. This and the Micronesian Scrubfowl, also rather isolated in the Pacific, are the two forms of *Megapodius* that really differ quite notably from all the other members of the genus, and the specific status of these two forms alone is undisputed. Had these birds been transported to their respective islands by human colonizers, it seems highly unlikely that there would have been sufficient time for them to differentiate to the degree that they have done.

Human arrivals on small islands have repeatedly led to a series of extinctions amongst the local wildlife. Archaeological evidence indicates that this process occurred in the South Pacific, and in some cases the chronicles of early European explorers provide additional, though sometimes none too reliable, evidence. It now seems very probably that this was the story with megapodes too in this region. Fossil and subfossil

evidence, including leg bones found in early middens, shows that megapodes formerly had a much more extensive distribution in the South Pacific, occurring, for example, in other parts of Tonga and also in other island groups. Local tradition in Fiji talks of the now extinct Sasa, a bird which was reportedly similar to a megapode. Until recently, there were no further clues, but excavations on Lakeba Island in Fiji revealed megapode bones in a midden full of other bird bones. This find was dated to about 900 BC, which is thought to be roughly the period in which this island was first occupied, so it appears that here at any rate, and perhaps throughout much of the South Pacific, indigenous megapodes were perhaps encountered by the first human settlers. The disappearance of the megapodes from several islands in the region, and in all probability from many others as yet unproved, implies that they may well have been persecuted to extinction, quite possibly by means of intensive, systematic hunting and egg-collecting.

However, at the western extreme of the megapodes' distribution, the situation appears quite different. It has been suggested that a form of *Megapodius* spread westwards, island-hopping and gradually occupying neighbouring islands, and thus expanding its range. Theoretically it would have colonized at least as far west as the Nicobars. Subsequently the species would have disappeared from all of the intervening areas of land west of the Philippines, Sulawesi and Lombok, including the immense islands of Sumatra and Java and all but the northern tip of Borneo, leaving the isolated population in the Nicobars. The causes of this mass disappearance would presumably have to be tied in with exclusion by Phasianidae or mammalian predators (see Habitat). This whole idea seems rather unlikely, as the extinction without trace from the mass of small islands in the intervening area that would presumably have been colonized appears unrealistic, while there is no obvious reason to explain why the Nicobar population should have survived.

In this case it would seem far more reasonable to suppose that this population did indeed originate from birds imported by humans, an idea already put forward by Alfred Russel Wallace in 1876. In support of this proposal is the fact that the grounds for recognizing this form as a separate species from the slightly differentiated Philippine Scrubfowl are essentially the geographical isolation of the two (see Systematics). An interesting coincidence is that megapodes were reported to have been introduced by a sultan to a small islet in the Maldive Islands during the nineteenth century, probably with birds brought from the Nicobars.

It is also interesting to note that the local names for megapodes in widely separated areas show great similarity. That the name "Maleo" is applied to the Sula Scrubfowl on Taliabu in the Sula Islands is not particularly remarkable, as the species to which this name is normally applied in literature, *Macrocephalon maleo*, is found very close by on Sulawesi. Likewise, the Philippine Scrubfowl is known on Sulawesi as "maleo kecil", or "small Maleo". However, of greater interest is the fact that the name "malau" is the local name for the Vanuatu Scrubfowl, and even more notable is the local name for the Polynesian Scrubfowl, once again "malau". This has been suggested as proof that the birds reached Polynesia by means of human transport, but all it probably means is that when the first colonizers arrived, they were already familiar with megapodes, so they naturally retained the word that already existed in their language, a process that has repeatedly occurred during colonizations, perhaps most notably throughout the Americas.

The megapode egg, with its remarkably high yolk content, offers a very rich source of protein to local human populations, which often have to survive on impoverished, rather unnutritious diets. Over the centuries, the eggs of many, probably most, megapode species have traditionally been harvested by the local human populations. In most areas, ancestral laws or customs prevented excessive exploitation, so that collecting was carried out at sustainable levels. Nevertheless, some isolated populations on Pacific islands were almost certainly wiped out as a result of excessive exploitation. It seems likely that egg-

collecting would have been an important factor, but there was clearly some hunting too, as indicated by the bones found in the middens of early settlers. However, in some areas, at any rate until recently, birds approaching camps and huts were not killed, as the locals realized that the eggs are a much more valuable source of protein than the flesh of the birds. The combination of hunting with intensive egg-collecting is likely to lead to rapid population declines over relatively short periods.

One of the major problems is that the sites used by megapodes for egg-laying, especially mounds or communal beaches, are usually rather prominent and easy to detect. This applies particularly to humans, but also to any other large predators, notably monitor lizards and in Australia introduced European foxes (see Breeding), and this vulnerability may be behind the absence of the family from continental Asia and most of the Greater Sundas (see Habitat).

In parts of New Guinea, a megapode mound is traditionally considered to be the property of whoever finds it, and the owner is entitled to take all of the eggs for consumption, sale or barter; he may wish to despoil it completely at once, or he may prefer to harvest the eggs periodically, by which method he is presumably likely to gain more in the long run, as long as his rights are respected.

A similar system operates in many areas with nesting beaches, and each small village, and sometimes each family, may have its own particular patch to which it has all the harvesting rights. In fact, where such hereditary systems are still in operation, they can imply a most efficient form of protection for the megapodes, as the local human population has vested interests in preserving the site and avoiding overexploitation. Such a site of the Moluccan Scrubfowl was recently rediscovered on the island of Haruku, off the south coast of Seram in the southern Moluccas. The site, first reported in 1894, had not apparently been visited by any ornithologist since 1953, until R. Dekker searched it out in 1991. He feared that the site would have ceased to be operational, like so many others of this threatened species, but was delighted to find a large communal laying site, just as described, which he estimated might be used by up to 4000-5000 pairs each year. Most importantly, this site is still protected by local custom, and all harvesting strictly controlled. One tenant has the comprehensive rights for egg harvesting at the site, a privilege for which he pays on an annual basis, and which appears to be respected by the local people. In fact, the whole site is strictly protected by local custom, which even prohibits firewood collection there. The tenant states that he deliberately leaves something in the region of 20% of the eggs, in order to maintain the population. This well organized site shows that, if properly organized for sustainable harvesting, exploitation can actually provide security for individual megapode populations, as it regularly did in the past, before the widespread disruption of local traditions.

Exploitation on a most amazing scale occurs at the largest known nesting concentration of any megapode species. At Pokilli, in central New Britain, an estimated 53,000 Melanesian Scrubfowl congregate at breeding grounds that are heated by geothermal activity. This site and others in the area have been exploited by the local people certainly for several centuries and probably since long before the arrival of the first Europeans in the region. As elsewhere, each site, or portion thereof, has its traditional owner. In the past full-scale wars were fought between the various tribes regarding ownership of the burrows, with the dead often being buried in the very burrows they had died defending. Convention traditionally protected the birds and their eggs from excessive exploitation, but with the arrival of the white man and his Western values, as well as increases in the human population, many local customs have been shattered, and the tacit restrictions affecting egg-collecting have been cast aside.

At Garu, another, much smaller site about 60 km west of Pokilli, it was found in 1971 that villagers were taking some 15,000 eggs per year. Despite legal protection of this site in 1975 and the imposition of restrictions that appear to have been accepted, a reassessment of the situation showed that over

30,000 had been taken in 1979. However, this falls into insignificance when compared with the activity at Pokilli. On any one day, over 200 people can be seen working the burrows here; after digging out the eggs, they wrap them in palm leaves and load them onto lorries which transport them back to the villages for sale. A rough estimate in the mid-1970's, based on the number of eggs taken per village, the number of villages involved and the length of the breeding season, suggested that about 4,890,000 eggs were collected per year, an estimate that was thought to be conservative!

In recent years an unexpected conflict has arisen in suburban Brisbane, in south-east Queensland. The Australian Brush-turkey used to be found regularly near the city centre, but it was largely restricted to several patches of forest and wooded parkland within the city limits. However, during the 1970's the species started colonizing residential zones too, mostly those abutting on the patches of forest, and this has led to a certain amount of conflict. Birds have taken to installing themselves in private and public gardens, city parks and precincts, and in such sites they set about building their mounds. Unfortunately, this can involve raking up somebody's flowerbeds or shifting the compost heap, and not surprisingly many householders find this a considerable nuisance, particularly as on occasions the birds can cause a fair amount of damage to property. Other people find them a bother to themselves and their children and also to their pets, and they are accused of stealing food laid out for the pets. Yet other householders are delighted to have the birds around them, and may be proud of having a successful mound on their property, sometimes encouraging the birds by feeding them, which has the inconvenient side effect of making the birds tamer and more likely to pester those who do not want them.

In response to complaints, several methods have been tried in attempts to eject the birds in places where they are not wanted, but as the problem is still fairly new, it is not yet certain which of these, if any, is the appropriate one. For instance, the relocation of birds, which requires legal authorization, seems to be fairly ineffective, particularly as birds may even come back again from quite some way off.

A recent study of the dynamics of this unusual population has produced some interesting findings. The overall success of suburban nesters averages considerably lower than that of wild populations nearby. The main causes of this seems to be the different proportions of the various mound materials, disturbance, direct human interference and the lower overall brush-turkey density. It is thought that most of the birds that arrive and set up territories are probably young males that are unable to compete and establish territories in the more traditional forest patches. While males of this species tend to remain on or by the mound much of the time, females visit the mound only for copulation and egg-laying, and so are much less likely to become tame, which may be a further factor in the low success of some mounds that are exposed to particularly high levels of disturbance.

The irony of this situation now is that the species would appear to be expanding, although this may be a false impression, given the high hatching failure. However, at the same time in the Brisbane area as a whole the species is increasingly threatened, as the projected development of several forested areas is liable to mean the loss of some of the most suitable patches of habitat in the whole of Greater Brisbane.

Archaeology and ornithology recently combined to solve a long-standing mystery. In northern Australia, in Arnhem Land and the Cape York Peninsula, a series of large mounds made mainly of earth and shells can be seen. The presence of shellfish refuse and some bone and stone artifacts in these mounds led scientists to the conclusion that they had been built by Aborigines, although nobody could produce a satisfactory answer as to how they were built or why. However, a recent re-examination of the material and comparison with similar, rather more recent sites shows that they are probably very old mounds of the Orange-footed Scrubfowl. The birds had built their mounds alongside earlier Aborigine sites, and had simply incorporated their rubbish into the mounds.

Status and Conservation

In the last decade or so, extensive research has been carried out on this hitherto poorly known family, mostly by members of the Megapode Specialist Group, which operates under the auspices of BirdLife International, the World Pheasant Association and the Species Survival Commission. Studies have been performed into many aspects of the breeding biology, ecology, taxonomy and conservation status of megapodes. Although the majority of this work not surprisingly continues to concentrate on those species found in Australia, there has been a concerted effort to improve coverage of the large number of poorly known species occurring elsewhere. Nevertheless, three whole genera, *Aepyodius*, *Talegalla* and *Eulipoa*, still remain virtually unknown in most of these aspects.

As part of the recent Conservation Assessment and Management Plan (see page 472), the status of each megapode species was individually reviewed. The Megapode Specialist Group had, in fact, already been investigating many of the lesser known species for some time, but the CAMP initiative has helped to clarify the situation. The results are alarming, if not altogether surprising. Whereas the IUCN Red List includes eight species as threatened, the reappraisal, using the new Mace-Lande categories (see page 19), concluded that a total of 11 of the 19 species should currently be classified as threatened. In addition, two races that may actually merit treatment as full species are also reckoned to be at risk. This compares most unfavourably with the 1978/79 Red Data Book, which listed only the Maleo and the two races of the Micronesian Scrubfowl; all three are still threatened.

The threats are essentially the same for all megapodes, although the case of the Malleefowl is, yet again, slightly different. Given the distribution and typical habitat of the family, it comes as no surprise that reduction in the extent of suitable habitat available is one of the chief threats in most cases. In its different forms it can be classified as habitat destruction, degradation or conversion, but in the long run it all comes down to habitat loss. Most megapodes are almost exclusively forest-dwellers, so they are directly affected by the unremitting forest destruction that the whole region is suffering. If the most widespread and persistent logging is perhaps in Indonesia, this is probably only because the Philippines have already suffered even greater ravages. Of the eight species that are still considered to be secure, four occur only on New Guinea and one exclusively in Australia, while one more is found extensively on these two great landmasses. The remaining two species, the Dusky and Melanesian Scrubfowl inhabit island groups in the vicinity of New Guinea, the former occurring in the north Moluccas and West Papuan islands, and the latter in the Bismarck Archipelago and the Solomons. Thus, it is the species in the core area that are generally the most secure, while the species with more marginal distributions are amongst those most at risk: the Maleo and the Nicobar, Philippine and Sula Scrubfowl in the west; the Micronesian Scrubfowl in the north; the Polynesian and Vanuatu Scrubfowl in the east; and the Malleefowl in the south.

Nor does the situation of the "secure" species leave room for complacency. Indonesia's fast escalating population and the associated transmigration schemes, together with Japan's insatiable demand for timber, suggest that the huge tracts of forest on New Guinea that are still largely undisturbed may soon be under threat. Also, there is very little hard information regarding the abundance of these species, and large proportions of their estimated total populations are the result of tentative extrapolations. Extensive surveys of all of the species found on New Guinea would be very welcome, and would be a starting point on which to base the subsequent monitoring of populations.

The second significant threat to megapodes in general is exploitation by human populations, mainly in the form of egg-collecting. There is a very long history of such exploitation, and it has probably already caused the loss of some species on Pacific islands. Where species have managed to survive in spite of exploitation, it was often due to their protection from over-

Remarkably, the *Sula* Scrubfowl was unknown in the wild until the 1980's, with only a few specimens collected for museums as proof of its existence. Recent surveys of the *Sula* and Banggai Islands, which together make up the entire range of the species, have shown that it is still quite common in parts of the former and widespread in the latter. However, with the large-scale commercial logging operations that are going on in these islands, for the time being the future of this species can not be regarded as secure.

[*Megapodius bernsteinii*,
Sula Islands.
Photo: M. Indrawan]



exploitation by local traditions (see Relationship with Man). The breakdown of these traditions, in conjunction with rapidly increasing human populations has already led to many local extinctions and is now jeopardizing the survival of several species.

The other main threat facing many members of the family is that of introduced predators, which can, of course, be related to exploitation by humans. Megapodes, like most other animals, have a series of natural predators, including monitor lizards which excavate the eggs, and birds of prey which take chicks and, on occasion, adults, but the balance of nature generally keeps the effects of such predators in check. On the other hand, there is no such allowance for introduced predators, especially cats, dogs and foxes, but perhaps also mongooses, rats and even snakes in places. While no megapode species is known to be at risk exclusively due to this factor, it is often a secondary cause that exacerbates the effects of either or both of the other principal threats.

Sadly, the first species to be studied in detail and brought to the public attention, the Malleefowl, is now considered to be threatened, and it numbers only a few thousand pairs. It used to be widespread throughout much of southern Australia in suitable habitat, most notably in mallee scrub, and it occurred at least as far north as Alice Springs in Northern Territory. Shooting by white settlers may have caused an initial decline, and it is also reckoned that the more static lifestyle which was forced upon Aborigines may have led to more concerted exploitation and local declines.

However, the main factors in the long run have undoubtedly been those affecting the species' habitat, which has suffered extensive agricultural conversion, generalized degradation and an alarming degree of fragmentation. Over the last century or so, there has been extensive clearing of the mallee to make the land suitable for the cultivation of wheat, and optimum areas of mallee with higher rainfall have mostly been cleared. The species is now rare or absent over about 80% of its former range, and the only remaining areas of mallee extensive enough to support viable populations are in Victoria and South Australia. In New South Wales, for example, the range does not appear to have shrunk, but the population is now extremely fragmented. The situation of the

species in Western Australia is very poorly known, although the species may be widespread in a slightly different type of woodland habitat.

In tandem with agricultural development is the expansion of livestock farming. Large areas of suitable habitat are stripped down by domestic herbivores, especially sheep and to a lesser extent goats, but probably also by rabbits. These exotic species feed heavily on much the same plants that constitute the Malleefowl's diet, and by sheer weight of numbers are driving the birds back. Food availability is known to be of great importance to Malleefowl, and its scarcity is a major factor in chick mortality (see Breeding). Where sheep have been allowed to graze in undisturbed stretches of mallee, Malleefowl density has been seen to decline notably and populations have slumped by 80-90% in some areas.

Another significant threat to this species is fire, which regularly has an integral role in the regeneration process of such Mediterranean-type ecosystems as the mallee. In recent years, major bushfires have become increasingly frequent in south-eastern Australia, with the result that the habitat does not have sufficient time to recover fully. Recently, the scale of devastation that such fires can cause in many parts of Australia was amply demonstrated by one that raged uncontrollably through Sydney in late 1993. Man also puts fire to his use, and on occasions has sparked off some of the most serious of all bush fires. One of the commonest uses is "controlled" burning of an area with the aim of improving the grazing for livestock, but in many areas this has been carried too far, so that the natural habitat is very seriously damaged. Unfortunately, the prime habitat for the species is of the most inflammable type, as the birds require an ample supply of plant litter for their mounds, so such optimum areas tend to lie thick in suitable dry fuel. Research has shown that Malleefowl reach their greatest densities in stands of mallee that have not suffered the effects of fire for over 60 years. However, in one of the strongholds of the species in Victoria, almost all of the habitat has been burnt since about 1960, and more than one third of it since about 1980. In combination with the already alarming rates of habitat loss and fragmentation, fire can suddenly wipe out whole populations, which then have virtually no chance of natural recolonization.

Another major factor in the decline of the species seems to be predation. There is a degree of natural predation by birds of prey and dingoes, but nowadays there are also two significant introduced predators. European foxes raid the mounds to dig up the eggs, and they have been found to account for as much as 37% of all eggs. They have also been found to cause mortality of up to 61% of the chicks. Feral cats also take some chicks, and will even occasionally take adults at their mounds. One of the first steps towards safeguarding the Malleefowl would be the elimination, or at least drastic reduction and control, of these introduced predators.

Until fairly recently, the species was thought to be reasonably common and secure, but it now seems that this was due, at least in part, to the fact that it is rather conspicuous and it could regularly be observed at several well known sites. The extreme fragmentation of the Malleefowl's habitat has several serious consequences. Contact is lost with other populations, so that recruitment from outside is impossible, which in turn leads to inbreeding and lower fertility. At the same time there is insufficient room for young birds to establish themselves, so those that manage to survive mostly have to move off to sub-optimum habitat, where the chances of breeding success are correspondingly lower. Finally, the process increases the risk of extinction of individual populations due to catastrophes, natural or man-induced.

In response to the alarming situation, the species has been afforded full protected status. Another important step has been the creation of a series of special mallee reserves, designed to conserve not only this unique species, but also its unique habitat, and scientists are examining the best possible ways of securing such areas against fire. At the same time, a captive breeding programme is in progress, with a view to the possibility of making reintroductions in New South Wales and South Australia, when and where appropriate.

In looking over the rest of the megapodes, it is noteworthy that, despite the recent attempts to establish the status of all species, even now virtually nothing at all is known about Bruijn's Brush-turkey. This species is only known to occur on the island of Waigeo, off north-west New Guinea, although on occasion it has been suggested that it might also occur on other West Papuan islands. Recent visits to Waigeo have been frustrating, as practically the only information obtained was a limited amount of hearsay from local villagers. As the species occurs in forest in the rugged, impenetrable karst interior of the island, it has proved extremely difficult to make any progress in the knowledge of this species, as the initial problem of actually managing to observe an individual has proved unsurmountable. Indeed, with only one specimen collected during the whole of the present century, the question was even raised as to whether or not the range of the species really was Waigeo.

The mere inaccessibility of the habitat does at least imply that the species is likely to be less subject to human interference than other megapodes at present, but there is now a threat that Waigeo might be opened up to cobalt mining. Were this to take place, access would inevitably be afforded to deposits in the interior of the island, presumably resulting in habitat destruction on an unpredictable scale and exploitation of the megapodes and their eggs by mine and ancillary workers. The extremely restricted range of the species suggests that it would probably be highly vulnerable to any form of exploitation.

Several other threatened species are also very poorly known, but steps are being taken to improve the overall coverage. In order to assure the survival of any threatened species, an adequate knowledge of its life history is essential, so that the satisfaction of habitat, feeding and breeding requirements, in particular, can all be guaranteed. One of the latest species to receive attention has been the Sula Scrubfowl, a species that until recently was unknown in the wild, but which has now been the object of initial survey work. The species was found to be relatively common on the island of Taliabu in areas of selectively logged forest. However, it suffers considerable, though irregular, hunting pressure, and the surroundings of some mounds are festooned with snares. It

seems that the periods of most intensive trapping coincide on the one hand with bad weather, when fishermen can not put out to sea, and on the other with school holidays, when many small children set their snares. It is interesting to note that here the islanders do not appear to exploit the birds' eggs. This species, and others like it, require the setting up and active preservation of a series of protected areas, as well as effective enforcement of the legal protection that it has theoretically enjoyed since 1931.

The status of the Nicobar Scrubfowl was until recently a matter of some confusion, as the species was first assumed to be fairly common, and then thought to be in serious decline, probably due to habitat loss and overexploitation. There was very little information to go on, partly because the Indian authorities did not concede visas to foreigners to visit the islands. However, in early 1992 access to the islands was permitted to R. Dekker, the first foreign scientist to visit the islands at any rate since the 1940's. Dekker found that over 80% of the main island of Great Nicobar was still covered in undisturbed primary forest, while surveys showed the species to be relatively common, apparently suffering only limited exploitation. Most importantly, over 500 km², roughly a quarter of the island, was designated for two national parks. Further surveys will indicate whether or not this species could be removed from the threatened list.

Although the Moluccan Scrubfowl overlaps extensively with the Dusky and Orange-footed Scrubfowl, and has a total range of comparable size with that of the former, it might be the most threatened of all megapodes, whereas the latter two species are considered to be secure. Perhaps even more surprising is the fact that in areas of overlap it is the Moluccan Scrubfowl that tends to occur at higher altitudes than the *Megapodius* species. While the lowland forest is invariably the first to be logged or disturbed, it seems that for some unknown reason the *Megapodius* species are both better able to withstand a certain degree of habitat disturbance, perhaps simply because they have a longer history of closer contact with humans. Nevertheless, it seems more likely that the key to the difference in status may lie in the fact that the Moluccan Scrubfowl is mainly a communal burrow-nester on sandy beaches, whereas the other two are habitually mound-builders. Once a communal laying site has been discovered by man, it can apparently be wiped out in a very short time by intensive egg-collecting. Although the status of this species is imperfectly known, and current opinion is perhaps based less on negative data than on the absence of positive data, along with the Maleo it should serve as a warning for the case of the still abundant Melanesian Scrubfowl, which is locally suffering very high levels of egg-collecting (see Relationship with Man).

The presence of megapodes in the Pacific was indicated by an egg purchased in Samoa in 1847, but it was not until 1864 that the Polynesian Scrubfowl was described, from the Tongan island of Niuafo'ou to which it is endemic. Only 40 years later, the species was nearly wiped out by the last steam blast eruption that rocked the island in 1886. It has been suggested that the megapode incubation system with the eggs buried under the ground for some two months before hatching might have been an important factor in the survival of the species, as it might have enabled the eggs to remain relatively unaffected by the heat and poisonous gases. However, the population had been greatly diminished, and around this time local chiefs imposed a ban on the collection of eggs and hatchlings, until the species recovered.

The actual size of the current population is not well known, but while one estimate put it as low as about 200 birds, another suggested at least 800; the latest estimate is of some 200 pairs. The species suffers regular egg-collecting and also predation by cats, which lie in wait for the females as they emerge from their laying burrows, but the inaccessibility of many nesting sites, at any rate to humans, acts as some kind of a safeguard. The most serious threat is probably the fact that the entire population of the species is restricted to a single volcanically active island; another eruption could exterminate it. With this in mind, in 1968 a few birds were released on Tafahi, another

Egg-collecting is one of the chief threats facing several megapode species, in particular all those that lay at communal sites. The Maleo has suffered more than most, with almost all of its known laying sites either abandoned or threatened. In response to this serious decline, major conservation work has been undertaken in recent years, including a series of measures designed to promote public awareness and involve local human populations actively in the conservation of this unique species.

[*Macrocephalon maleo*,
Sulawesi.
Photo: Alain Compost/
Bruce Coleman]



island in the Tonga group, which is formed of a steep volcanic cone. However, subsequent visits indicate that the scrubfowl apparently failed to establish itself. A further threat loomed in 1991, when the Tongan government was considering a project to build a crude oil depot on Niufo'ou. It was considered that the approval of these plans would almost inevitably lead to the extinction of the Polynesian Scrubfowl. Fortunately, however, the plans seem likely to be dropped.

One of the most distinctive, and also one of the most threatened, megapode species is the Maleo, a representative of the peculiar endemic fauna of Sulawesi. The species is still fairly widespread, mainly in the north of the island, but it suffers greatly at the hands of egg-collectors. Maleos lay communally on beaches or in areas influenced by geothermal heat. Surveys over recent years have come across several new laying sites, but as fast as these sites are discovered others are being deserted by the birds, and some of the newly located sites are already overexploited. In 1992, a total of 85 sites were known, of which 22 had already been abandoned and 51 were active, while the status of the remaining 12 was unknown. However, of the active sites all but one or two were severely threatened. The largest known concentrations were recorded in the early 1980's at Bakiriang in east Sulawesi, where up to 100 birds were seen on a single morning. Subsequently this laying site was thought to have been abandoned due to habitat destruction, related to a nearby transmigration settlement, but birds were present again by 1991, when some 40 were seen together.

Although the collection of Maleo eggs is illegal, the law is not enforced. At the same time, other factors are known to be having a significant negative impact on the species, including logging, disturbance, predation by village dogs and trapping. Many steps have already been taken to combat the rapid decline of the Maleo, and the species is now the object of a major conservation programme. This involves a good deal of survey work and research, but perhaps most importantly a public awareness campaign, designed to reach people through posters, leaflets and newspaper articles, and even publicity of the project on television. Another conservation move made in recent years is the setting up of artificial hatcheries. Megapode eggs can be incubated fairly easily, especially at hatcheries alongside

laying sites, and as the chicks require no parental care, this is a relatively easy way of bolstering natural populations, in which recruitment has presumably decreased notably.

Another measure could prove to have important implications for this and other megapode species. Communal laying grounds might be suitable sites for the promotion of wildlife tourism, with small parties of tourists being accompanied to a position at a prudent distance, from which to watch and possibly photograph the birds excavating their burrows prior to laying. However, any such initiatives must be carefully planned and co-ordinated, with strict control and vigilance. Ecotourism is potentially one of the few ways of using wildlife to boost local economies without necessarily causing harm or undue disturbance to the wildlife itself. However, unless it is properly planned and managed it can often be just as damaging as many forms of direct exploitation, as has been seen at seabird colonies and the laying beaches of marine turtles. Equally, the system is most unlikely to succeed if it does not actively involve members of the local human population, and all too often such concerns are set up and run by incomers in search of quick profits. Another important consideration is that there would be little use in preserving a laying beach if the appropriate foraging habitat of the hinterland were not integrated into the same conservation measures. Notwithstanding these strict limitations, this projected scheme may have the potential to provide security for several species.

General Bibliography

- Ackerman & Seagrave (1987), Balouet & Olson (1989), Booth (1988b), Booth & Thompson (1991), Clark (1960, 1964a, 1964b), Coomans de Ruiter (1962), Cracraft (1973), Dekker (1988a, 1989, 1990a, 1991-1993), Dekker & Brom (1990), Dekker & Jones (1992), Dekker & Wattel (1987), Diamond (1983), Friedmann (1931), Frith (1956a, 1985), Grahame (1980), Jones (1989), Jones & Birks (1992), Lister (1911), McGowan, Carroll & Ellis-Joseph (1994), Mey (1990), Olson (1980), Peters (1934), Poplin & Mourer-Chauviré (1985), Raethel (1988), Seymour (1985), Seymour & Ackerman (1980), Seymour, Vleck & Vleck (1986), Seymour, Vleck *et al.* (1987), Shuker (1991), Sibley & Ahlquist (1990), Sibley & Monroe (1990), Sibley *et al.* (1988), Steadman (1989), Stock & Bunch (1982), Sych & Bogdanovich (1988), van Tets (1974), Verheyen (1956), Vleck *et al.* (1980).

ssp. purpureicollis



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1

ssp. lathamii



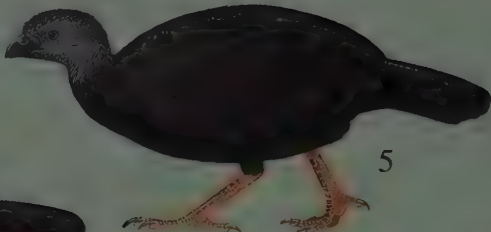
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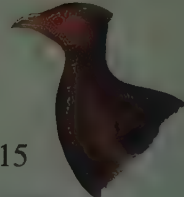


10



11

ssp. geelvinkianus



15



12



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14



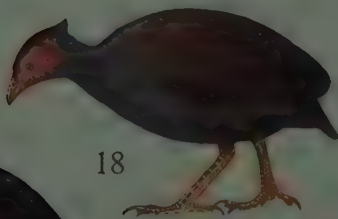
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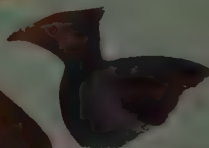


18



19

ssp. tenimberensis



ssp. forstenii



ssp. reinwardt

PLATE 29

inches 8
cm 20

Genus *ALECTURA* Latham, 1824

1. Australian Brush-turkey

Alectura lathamii

French: Talégalle de Latham **German:** Buschhuhn **Spanish:** Talégalo Cabecirrojo
Other common names: Australian Scrub-turkey/Bush-turkey, Wild Turkey(!); Purple-pouched Brush-turkey (*purpureicollis*); Yellow-pouched Brush-turkey (*lathamii*)

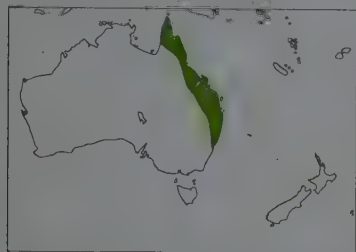
Taxonomy. *Alectura lathamii* J. E. Gray, 1831, near Sydney, New South Wales. May be most closely related to *Aepyodius*, as suggested by some similarities in behaviour at mound, extensive brightly coloured bare skin with adornments on neck, round nostrils and white eggshell. Two subspecies recognized.

Subspecies and Distribution.

A. l. purpureicollis (Le Souëf, 1898) - N Queensland.

A. l. lathamii J. E. Gray, 1831 - C & S Queensland, NE New South Wales.

Introduced to Kangaroo I (off South Australia), where still survives; also to Dunk I (off EC Queensland), where may persist; in past, released at Kaipara in N North Island (New Zealand), but species failed to become established.



Descriptive notes. 60-70 cm; male averages 2450 g, female 2210 g. Unmistakable within range, due to large size, brightly coloured bare skin and mostly black plumage with whitish scaling on most of underparts. Largest megapode: considerable size variation, perhaps clinal or individual, with largest birds in S. Colour of head and neck can be much brighter during courtship, generally much duller outside breeding season, when pouch shrinks. Iris pale brown to yellow or cream. Female averages slightly smaller; has very small neck pouch. Race *purpureicollis* has pouch pink to purple; iris tends to be paler.

Habitat. Typically occurs in closed areas of rain forest along coast, in tropical and warm temperate zones; also found in wide variety of other habitats, including dry sclerophyll woodland, gallery forest, eucalypt forest and swamp woodland. Main preference may be for dense understorey, as frequently occurs in areas with extensive growth of introduced lantana (*Lantana camara*); often found along dry creeks; tends to build mounds in areas with closed canopy and sufficient supply of leaf litter (not normally *Eucalyptus*). Increasingly occupies disturbed habitats and even city suburbs, where will build mounds in public and private gardens (see page 298); forms feeding flocks at rubbish dumps.

Food and Feeding. Very poorly known. Omnivorous, with apparent preference for plant food, but no quantitative analyses performed. Seeds, grain, shoots, roots, fruit and berries of many species recorded. Animal food includes gastropods, worms, insects and their larvae; carrion also recorded. Normally scratches for food in leaf litter; takes fruit of prickly pear (*Opuntia*) in flight (see page 286); excavates and feeds on roots of *Aracaria cunninghamii*, causing damage to plantations; also recorded digging termites out of rotten wood. Young chicks feed mainly on invertebrates at first, before progressing onto seeds.

Breeding. Mound-building starts May-Jun (winter) in SE Queensland; mounds abandoned Jan-Feb. Males simultaneously polygynous, females serially polyandrous; females tend to be loyal to single male for several weeks. Mound-builder. Mound built by male in c. 37 days (14-77); typically contains damp leaf litter and earth, sometimes with other debris; average 85 cm high x 300-400 cm across, containing 2-4 t of material, although average 6-8 t on Kangaroo I, where species introduced; mound temperature relatively stable at c. 31°-36°C (average 33-3°C), with limited regulation. Several females may lay in any one mound, which is property of single male; males may tend two active mounds; up to 58 eggs (average 12) laid in single mound per season. Each female can lay 15-27 eggs in a season. Incubation 47-52 days (in captivity). Chick has soft brown down and well developed wing feathers; weight at hatching c. 120 g, at 20 days 200 g, at 50 days 460 g, at 100 days 1300 g, at 200 days 2100 g. Hatching success of 86-6% recorded (499 eggs), but only 3-10% survived to subadult stage.

Movements. Sedentary. Males remain within home range all year round and in successive years; home range considerably larger during breeding. Sporadic records outside normal range probably refer mostly to escapes or (illegal) translocations.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Total population reckoned to be stable at over 100,000 individuals. Main problem is clearing of forested areas, which has reduced distribution, especially W of Great Dividing Range; also fragmentation of habitat, and in past hunting, which have caused some local extinctions; around 1902, almost exterminated by shooting from Murphy's Creek area (SE Queensland), where previously common. Early in present century, when prickly pear spread far inland, present species expanded range correspondingly, as used succulent parts of fruit for mound material in arid areas; with control and eventual removal of plant, birds retreated into traditional range. During same period, significant contractions in southern parts of range. Recently expanding into suburban parts of Brisbane, SE Queensland, where frequently comes into conflict with human population (see page 298). Predators include cats, foxes, dogs and dingoes; probably some disturbance of mounds and predation of eggs and chicks by pigs and perhaps also snakes and lace monitors (*Varanus varius*). In 1936 single pair introduced to Kangaroo I (off South Australia), where species continues to flourish. Captive population numbers c. 250 birds.

Bibliography. Balun (1969), Birks (1990, 1991, 1992), Booth (1985, 1989b), Brookes (1919), Coles (1937), Delacour (1935), Dow (1980, 1988a, 1988b), Fleay (1937), Jacobs (1970), Jones (1979, 1985, 1987a, 1987b, 1988a, 1988b, 1988c, 1989b, 1991a, 1990b), Jones & Everding (1991), Kaveney (1958), Keys (1990), Marchant & Higgins (1993), Schodde & Tidemann (1988), Seymour (1991), Seymour & Bradford (1992), Seymour & Rahn (1978), Suttie (1965), Troy & Elgar (1991), Vleck *et al.* (1984).

Genus *AEPYPODIUS* Oustalet, 1880

2. Wattled Brush-turkey

Aepyodius arfakianus

French: Talégalle des Arfak **German:** Kammtalegalla **Spanish:** Talégalo Carunculado
Other common names: Wattled Scrub-turkey

Taxonomy. *Talegallus arfakianus* Salvadori, 1877, Arfak Mountains.

Wattles of bare skin on neck and solitary behaviour at nesting mound may imply species is more closely related to *Alectura* than to *Talegalla*, although breeding habits of latter virtually unknown. Two subspecies recognized.

Subspecies and Distribution.

A. a. arfakianus (Salvadori, 1877) - mountains of New Guinea.

A. a. misolensis Ripley, 1957 - Misool I (off NW New Guinea).



Descriptive notes. 38-46 cm; male 1600 g, female 1200 g. Dark reddish brown rump and uppertail-coverts; legs and feet bluish grey to olive brown. Bright reddish comb and neck wattle of male duller outside breeding season. Female smaller, with duller colouring on head and smaller wattles. Race *misolensis* smaller, with thinner bill.

Habitat. Montane forests at 750-2800 m. Race *misolensis* occurs at much lower altitudes, around 300 m.

Food and Feeding. Fallen fruits and seeds; probably also insects. Ingests large amounts of small stones to help break down food.

Breeding. Apparently during most of year, with eggs from all months except Jul, Aug and Nov. Mound-builder. Mound is usually fairly steep-sided heap of leaves and twigs, c. 300 cm wide and 150-180 cm high; mound may be property of male. In captivity: mound built by male; 20 eggs laid by single female in c. 4 months, at intervals of c. 6 days; eggs laid in mounds with temperature of 29.4°-34.3°C. Mounds parasitized by *Megapodius* (?affinis) in SC New Guinea. Chick weighs 115-125 g at hatching.

Movements. Presumably sedentary. Normally solitary or in pairs. When disturbed, tends to fly up into tree.

Status and Conservation. Not globally threatened. Mace-Lande: Safe; *misolensis* possibly vulnerable. Total population of species possibly numbers 10,000-1,000,000 individuals; thought to be stable, and no significant threats known. In Irian Jaya (W New Guinea), widespread and fairly common, but thinly distributed and little known; uncommon in Papua New Guinea; may occur on Yapen I. Regularly encountered in suitable habitat, although inconspicuous. Suffers from intensive egg-collecting, and casual hunting of adults, but thought to be secure in areas where human population is sparse. Legally protected in Indonesia. Captive population numbers c. 10 birds. Race *misolensis* suffering from habitat destruction; may number 100-10,000 birds at present, but extensive survey work required in order to gain more accurate idea of population size and extent of threats.

Bibliography. Anon (1986), Bechler *et al.* (1986), Coates (1985), Diamond (1972), Dwyer (1981), Flieg (1970), Holmes (1989), Kloska (1986), Kloska & Nicolai (1988), Mayr (1930), Parker (1967), Ripley (1960, 1964), Rohlf *et al.* (1985).

3. Bruijn's Brush-turkey

Aepyodius bruijnii

French: Talégalle de Bruijn **German:** Braunbrustalegalla **Spanish:** Talégalo de la Waigoe
Other common names: Waigoe Brush-/Scrub-turkey

Taxonomy. *Talegallus Bruijnii* Oustalet, 1880, Waigoe. Monotypic.

Distribution. Waigoe I, to NW of New Guinea.



Descriptive notes. 41-46 cm. Male has three pendant wattles on neck. Brown underparts; legs and feet very heavy. Female and immature lack neck wattles.

Habitat. Evergreen forest in rugged karst interior of island.

Food and Feeding. No information available.

Breeding. No information available. Thought to be mound-builder.

Movements. No information available. Presumably sedentary.

Status and Conservation. RARE. Mace-Lande: possibly Endangered. Total population possibly numbers as few as 100-2500 individuals.

ails; trends and potential threats unknown. Virtually no information available; extensive survey required, and preservation of habitat must be guaranteed. Only one bird collected during present century; in past, absence of records led to considerable doubt as to whether or not range of species was really Waigoe I. Recent opinion suggests species may be less seriously threatened than usually suspected, as interior of Waigoe is extremely inaccessible to humans. Habitat apparently remains intact, but very little solid proof, and considerable damage caused by forest fires in 1982; c. 153,000 ha (almost half of Waigoe I) currently included in nature reserve. Threats of logging and interference by visiting fishermen thought to be of minor consequence; cobalt reserves on Waigoe could be

On following pages: 4. Red-billed Brush-turkey (*Talegalla cuculieri*); 5. Black-billed Brush-turkey (*Talegalla fuscescistris*); 6. Brown-collared Brush-turkey (*Talegalla jobiensis*); 7. Malleefowl (*Leipoa ocellata*); 8. Malco (*Macrocephalon maleo*); 9. Moluccan Scrubfowl (*Eulipoa wallacei*); 10. Polynesian Scrubfowl (*Megapodius pritchardii*); 11. Micronesian Scrubfowl (*Megapodius lapurensis*); 12. Nicobar Scrubfowl (*Megapodius nicobariensis*); 13. Philippine Scrubfowl (*Megapodius cumingi*); 14. Sula Scrubfowl (*Megapodius bensteadii*); 15. Dusky Scrubfowl (*Megapodius freycineti*); 16. Melanesian Scrubfowl (*Megapodius eremita*); 17. Vanuatu Scrubfowl (*Megapodius layardi*); 18. New Guinea Scrubfowl (*Megapodius affinis*); 19. Orange-footed Scrubfowl (*Megapodius reinwardi*).

source of problems in future. Possible record from nearby Batanta I (to S) in 1986. No birds known to be held in captivity.

Bibliography Bechler *et al.* (1986), Collar & Andrew (1988), Holmes (1989), Mayr (1930), Meyer de Schauensee (1940), Rand & Gillard (1967).

Genus *TALEGALLA* Lesson, 1828

4. Red-billed Brush-turkey

Talegalla cuvieri

French: Talégalle de Cuvier **German:** Rotschnabeltalegalla **Spanish:** Talégalo de Cuvier
Other common names: Red-billed Scrub-turkey

Taxonomy. *Talegalla Cuvieri* Lesson, 1828, forests of New Guinea = Manokwari.

Genus sometimes misspelt *Talegallus*. Monotypic.

Distribution. Salawati I, Misool I and NW New Guinea E to Mimika R and Geelvink (Cenderawasih) Bay.



Descriptive notes. 45-56 cm. Black all over, with orangish red bill and pale orange legs and feet; bare skin on face pale greenish yellow; iris yellow.

Habitat. Forested areas in lowlands and hills, occurring up to 1600 m. In zones of overlap with *T. fuscirostris*, present species occupies higher ground.

Food and Feeding. No information available.

Breeding. Female in breeding condition collected in Nov on Misool I. Mound-builder. Chick dark brown, with chestnut collar.

Movements. Presumably sedentary. Flies heavily into trees when disturbed.

Status and Conservation. Not globally threatened. Mace-Lande: possibly Vulnerable. Total population might number 1000-100,000 individuals; currently thought to be in decline. Until recently regularly encountered in suitable habitat, and species was thought to be secure in areas where human population was sparse. Suffers from intensive egg-collecting, and casual hunting of adults, but main threat now is degradation of habitat. Extensive surveys required. No birds known to be held in captivity. Protected by Indonesian law.

Bibliography Bechler *et al.* (1986), Bergman (1963), Dekker (1991b), Diamond (1972), Holmes (1989), Mayr (1930), Ripley (1960, 1964).

5. Black-billed Brush-turkey

Talegalla fuscirostris

French: Talégalle à bec foncé **German:** Schwarzschnabeltalegalla **Spanish:** Talégalo Piquinegro
Other common names: Yellow-legged Brush-turkey, Black-billed Scrub-turkey

Taxonomy. *Talegallus fuscirostris* Salvadori, 1877, Epa and Hall Sound, New Guinea. Two subspecies recognized.

Subspecies and Distribution.

T. f. occidentis C. M. N. White, 1938 - Aru Is: SW New Guinea.

T. f. fuscirostris Salvadori, 1877 - SE New Guinea.



Descriptive notes. 51-53 cm; 1275-1330 g. Greyish black bare skin on side of head; iris brown to reddish brown; bill ranges from very dark brown to black; pale greenish yellow legs and feet. Juvenile is smaller, duller version of adult, with brownish patch on hindneck. Race *occidentis* smaller.

Habitat. Rain forest, monsoon forest and sometimes gallery forest, mostly in lowlands but up to 800 m or possibly higher in places; known to occur in areas of disturbed forest. Altitudinal segregation apparently operates in areas of overlap with *T. cuvieri* in W of range and with *T. jobiensis* in E, present species occurring at lower altitudes. In many areas sympatric with *Megapodius reinwardi*, sometimes breeding in close proximity. Normally breeds on dry, level ground.

Food and Feeding. Insects, grubs and fallen fruits; may take small lizards. Occasionally drinks from forest pools during dry weather.

Breeding. Laying apparently all year round; evidence suggests possible peaks in wet season in lowlands, but in dry season at higher altitudes of 700-800 m. Mound-builder. Mound consists mainly of dead leaves, as well as some sticks, usually placed at base of large tree; mounds fairly flat, measuring up to c. 700 cm x 540 cm and 60-100 cm high. Mound thought to be used for few years, and then abandoned. Chick uniform dark brown, with yellowish ochre throat and centre of belly.

Movements. Presumably sedentary. Mostly seen singly or in pairs; usually runs away, but occasionally flies off high through trees. In one area of rain forest in lowlands, density of 3 birds/10 ha recorded, though no evidence of breeding.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Total population might number 10,000-1,000,000 individuals, but declining. Widespread and common in Irian Jaya (W New Guinea), widespread and fairly common in Papua New Guinea; regularly encountered in suitable habitat. Main threats are conversion and degradation of habitat; suffers from intensive egg-collecting, and casual hunting of adults, but species thought to be secure in areas where human population is sparse. In Papua New Guinea, wherever human population sizeable, species rapidly exterminated by hunters. Legally protected in Indonesia. No birds known to be held in captivity.

Bibliography Bechler *et al.* (1986), Bergman (1963), Coates (1985), Dekker (1991b), Diamond (1972), Holmes (1989), Mayr (1930), Ripley (1964).

6. Brown-collared Brush-turkey

Talegalla jobiensis

French: Talégalle de Jobi **German:** Halsbandtalegalla **Spanish:** Talégalo Patiritojo
Other common names: Collared/Red-legged/Brown-billed Brush-turkey

Taxonomy. *Talegallus jobiensis* A. B. Meyer, 1874, Jobi (Yapen) Island.

Two subspecies recognized.

Subspecies and Distribution.

T. j. jobiensis A. B. Meyer, 1874 - Yapen I; NC New Guinea.

T. j. longicauda A. B. Meyer, 1891 - E New Guinea, W to R Sepik and possibly R Aroa.

Exact limits of range uncertain in many areas. Several records of *Talegalla* in CE New Guinea; identity uncertain, but may well refer to present species.



Descriptive notes. 53-61 cm. Dark reddish tinge on bare skin of face and neck; legs and feet orange to dull red; reddish brown collar; iris brown; bill brown. Race *longicauda* slightly larger.

Habitat. Forested zones from sea-level up to 1800 m; seems to prefer dry ground, and tends to avoid areas of swamp forest; in higher parts of range, often found in ravines. In area of R Aroa (SE New Guinea) assumed to occur at higher altitudes than *T. fuscirostris*. Roost recorded c. 8 m up in large forest tree; copious droppings on ground below.

Food and Feeding. No information available.

Breeding. Female in breeding condition collected in Sept in NC New Guinea. Mound-builder; also said to be parasitic. Mound flat and wide, sited between large trees; alternatively, very large heap of humus measuring 100-450 cm wide x 150 cm high; mound temperature c. 32°-36°C. Usually used by pair, once by 3 birds. Said to parasitize mounds of *Megapodius affinis* in NC New Guinea, but inverse seems far more likely, and probably recorded in SC New Guinea (see page 290). Much predation of eggs by monitor lizards (*Varanus*). Chick weighs 125 g at hatching, 292 g at 6 weeks old.

Movements. No information available. Presumably sedentary.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Total population might number 10,000-1,000,000 individuals, but declining. Regularly encountered in suitable habitat; common and widespread in Irian Jaya (W New Guinea). Main threats are conversion and degradation of habitat; some protected areas should be designated; suffers from intensive egg-collecting, and casual hunting of adults, but species thought to be secure in areas where human population is sparse. In Papua New Guinea, wherever human population sizeable, species rapidly exterminated by hunters. Legally protected in Indonesia.

Bibliography Bechler *et al.* (1986), Bergman (1963), Coates (1985), Dekker (1991b), Diamond (1972), Dwyer (1981), Holmes (1989), Mayr (1930), Ripley (1964).

Genus *LEIPOA* Gould, 1840

7. Malleefowl

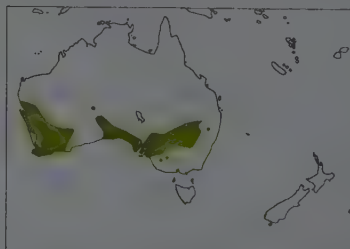
Leipoa ocellata

French: Léipoa ocellé **German:** Thermometerhuhn **Spanish:** Talégalo Leipoa
Other common names: Lowan

Taxonomy. *Leipoa ocellata* Gould, 1840, Swan River, Western Australia.

E populations sometimes split off into separate race, *rosinae*. Monotypic.

Distribution. SW & S Australia E to NW Victoria and EC New South Wales. Introduced to Kangaroo I (off South Australia), where probably now extinct.



Descriptive notes. c. 60 cm; male 2020-2050 g, female 1520-2050 g. Most distinctive megapode, with pale, patterned plumage; flattened crest. Female averages slightly smaller and lighter than male. Immature similar to adult but smaller.

Habitat. Woodland and scrub of semi-arid areas in temperate zone, especially areas dominated by dwarf mallee (*Eucalyptus*), where annual rainfall totals 300-430 mm; less abundant in mallee with lower rainfall of 220-300 mm. Common in areas of mulga (*Acacia aneura*); also found in areas with other *Acacia* and *Callitris*, and in places occurs in dry

coastal heath. Optimum habitat apparently has near-complete canopy and often rich layer of shrubs, but is fairly clear at ground level. In NE Victoria, favours patches of tall broombush (*Melaleuca uncinata*) more than 30 years old. Abundant food required in immediate environs of mound, as male's attention to mound is almost perpetual during certain periods of year (see page 289).

Food and Feeding. Omnivorous, but probably mainly granivorous. Buds, flowers, fruits and seeds of shrubs, especially legumes; also seeds, flowers and leaves of herbs, especially seedlings. Other items recorded include fungi and wide variety of invertebrates, e.g. beetles, cockroaches, dragonflies, bees, ants, spiders; birds do not apparently search actively for invertebrates, which are simply taken whenever encountered. Observations in W New South Wales showed that birds fed on: buds, fruits and seeds (during 73% of observations), especially *Cassia eremophila*, *Acacia* and *Beyeria opaca* (58%); herbs (10%); and insects (17%). In Victoria, observed targets of pecks: 49% herbs; 37% lerps (*Glycyaspis*); 7% fungi (mostly *Myceana*); and 4% assorted invertebrates. In South Australia, dry weight of crop and gizzard contents gave: 53% seeds of *Dodonaea bursarifolia*; 41% seeds of *Cassia melanantha*; and 22% sand (ingested to help break down food). Considerable seasonal variation in diet: insects mainly in spring; herbs (autumn/winter/spring); buds (winter/spring); flowers (spring/early summer); and seeds (summer/autumn); buds and berries of

Beyeria opaca particularly important in spring and summer. Main food types are seeds of legumes in summer, but herbs in autumn and winter. Adults reckoned to require c. 37 g of seeds (300-2200 seeds) per day. Hatchlings can feed on insects on same day as hatching. See page 286.

Breeding. Mound-building starts Apr/May; laying starts mid-Sept/mid-Oct in W New South Wales. Generally monogamous, with strong pair-bond, but one record of polygyny. Mound-builder. Mound built mainly by male, using leaves, sticks, bark, debris and sand; foundation crater of mound c. 300 cm wide x 90 cm deep; mound temperature relatively constant at c. 29°-38°C (average 33°C), regulated mostly by male. Mound tended by male for 9-11 months per year; old mounds (of same or different pair) often dug out and reused, but normally after being left unused for 1 year or more. Single female normally lays 15-24 eggs (2-34) per season; eggs laid at average interval of 6-4 days (4-17); incubation averages 62-64 days (49-96). Chick has down above dark brown barred pale buff, below pale brown, with wing feathers well developed; weight at hatching c. 107 g, at 20 days 146 g, at 60 days 300 g, at 100 days 450 g, at 200 days 800 g, at 500 days 1580 g. Hatching success: 79% (for 289 eggs) in zone where no predation of eggs by foxes, though several adults eaten; 49.5% (for 1094 eggs) in area with heavy predation by foxes (37%); 51% (for 530 eggs) in area with limited predation by foxes (5.6%), but many eggs lost in saturated mounds (11%), and many infertile (14%); chick mortality assumed to be very high. Sexual maturity at 4 years old, in captivity.

Movements. Sedentary; male tends mound for 9-11 months of year, at times returning at hourly intervals. In area of low rainfall in South Australia: home range of c. 4 km²; density of 1-1 pairs/km². In area of higher rainfall (300-400 mm/year), in New South Wales, during breeding season: males remained within 100 m of mound, females within 250 m. Territory and mound normally abandoned by Apr, but often for little more than 1 month. Mounds rarely placed on same site during two successive years, but usually within radius of c. 500 m.

Status and Conservation. VULNERABLE. Mace-Land: Vulnerable. Total population numbers only 1000-10,000 individuals, and declining. Estimated populations: New South Wales c. 745 pairs; Victoria under 1000 pairs; no figures available for South Australia, but population reckoned to be small; Western Australia may have largest population, but little known. Formerly widespread in suitable habitat from Western Australia to New South Wales and NW Victoria; in 1920's and 1930's also bred as far N as Alice Springs (Northern Territory), and perhaps even further N; now absent or rare in 80% of range: population of SW Northern Territory probably now extinct; still declining in New South Wales; Victoria and South Australia contain only remaining areas of mallee extensive enough to support viable populations. Precarious status long ignored, because species locally conspicuous. In New South Wales, range has not apparently shrunk, but population now extremely fragmented; small remnants of mallee in wheatbelt, where species occurs at high densities; larger numbers, at much lower densities, in more intact areas to W, including contiguous reserves of Yathong, Round Hill and Nombinnie, totalling c. 250,000 ha, but most of this is suboptimal habitat; surveys at Round Hill Nature Reserve in 1979-1982 revealed population density of 0.03 pairs/km², as opposed to estimate from 1950's of 0.15-1.54 pairs/km². Main threats are destruction and fragmentation of habitat, effects of grazing livestock, fire and introduced predators. In second half of present century much loss of habitat due to conversion for agriculture; extensive clearing of mallee for wheatlands over last century or so; optimum areas of mallee with higher rainfall have mostly been cleared; large areas used for grazing by sheep, and in such areas population of present species found to drop by 80-90%; goats and rabbits also contribute to habitat deterioration. In NE Victoria, cyclical cutting of broombush for fencing material removes a favoured habitat of species; such patches also particularly threatened by periodical bush fires; excessive controlled burning of habitat to improve grazing. Many eggs taken by introduced European foxes (*Vulpes vulpes*) and significant predation by feral cats. Fragmentation of habitat leads to inbreeding, and increases risk of extinction of individual local populations due to catastrophes, natural or man-induced. Several special mallee reserves created; captive breeding in progress, with a view to reintroduction in New South Wales and South Australia. Extensive survey required, along with constant monitoring of populations; preservation and management of habitat necessary, especially with respect to fire risk; competing grazers should be controlled and, in places, removed; introduced predators should be eradicated. See page 299.

Bibliography. Benshemesh (1988, 1990, 1992), Blakers *et al.* (1984), Board *et al.* (1982), Böhner & Immelmann (1987), Booth (1984, 1985, 1986, 1987a, 1987b, 1987c, 1987d, 1988a, 1989a, 1989b), Booth & Seymour (1984, 1987), Brandie (1991), Brickhill (1982, 1984, 1985, 1987a, 1987b), Brouwer & Garnett (1990), Christie (1993), Collar & Andrew (1988), Cooper (1966), Frith (1955, 1956b, 1957, 1959a, 1959b, 1962), Garnett (1992), Griffiths (1954), Immelmann & Böhner (1984a, 1984b), Jones (1963a, 1963b), Kimber (1985), Korn (1986), Lewis (1940), Marchant & Huggins (1993), Priddel (1990), Priddel & Wheeler (1990), Robinson *et al.* (1990), Rowley (1975), Schodde & Tidemann (1988), Tarr (1965), Vleck *et al.* (1984), Weathers, Seymour & Baudinette (1993), Weathers, Weathers & Seymour (1990), Woinarski (1989).

Genus MACROCEPHALON S. Müller, 1846

8. Maleo

Macrocephalon maleo

French: Mégapode maléo **German:** Hammerhuhn **Spanish:** Talégalo Maleo
Other common names: Maleofowl, Gray's Brush-turkey

Taxonomy. *Macrocephalon maleo* S. Müller, 1846, Sulawesi. Alternative genus name, *Megacephalon*, obsolete. Monotypic.

Distribution. N, C & SE Sulawesi, probably also Buton (Butung) I, off SE Sulawesi. Populations, probably introduced, formerly occurred off NE Sulawesi on Lembeh and perhaps Bangka, and also on several of Sangihe Is.

Descriptive notes. 55 cm. Unmistakable. Prominent dark bony casque. Salmon pink wash on lower breast and belly of variable intensity; thighs black, but sometimes obscured by belly feathers.

Habitat. Lowland and hill forest, with records up to 1200 m; descends to breed on beaches along coast or in forest clearings with sandy substrate; sometimes breeds on beaches backed by mangroves. Recently found laying eggs in black sand along shores of lakes. Of 85 laying sites known historically by 1992, 48 were on coast and 37 inland.

Food and Feeding. Known to feed on fallen fruits, insects and invertebrates. No further information available.

Breeding. Laying throughout year, with peak Oct-Apr in N Sulawesi; eggs May-Jul and Nov-Jan in SE Sulawesi. Apparently monogamous, maintaining pair-bond throughout year. Communal burrow-nester, using geothermal sites and also solar-heated beaches. Burrows up to 300 cm wide, and often over 100 cm deep; eggs typically buried 20-60 cm below surface; incubation 60-80 days, in soil



Status and Conservation. VULNERABLE. CITES I. Mace-Land: Vulnerable/Endangered. Total population probably numbers only 1000-10,000 individuals, and declining. Main body of population on Minahasa Peninsula (N Sulawesi); estimate from 1970's gave 3000 adults using 13 known breeding grounds; in mid-1980's, estimated 150-200 pairs each at Tambun and Tumokang in Dumoga-Bone National Park, where nine further laying sites known; by 1991 population at former had increased slightly. Some colonies known to have been exterminated during 1980's; several colonies recently discovered in C Sulawesi, but some threatened by habitat loss to agricultural development in association with transmigration, and two already being exploited, one for 40 years; new sites also found in S Sulawesi in 1989/90, but some already being exploited by villagers. In 1990/91, total of 34 sites surveyed, of which 25 previously unrecorded; most sites already abandoned or severely threatened by excessive egg-collecting, often by unauthorized persons. In 1992, total number of sites known 85, of which 22 abandoned, 51 active, and 12 unknown; 19 of the 22 sites abandoned were coastal; all but one or two of active sites severely threatened. Largest known concentrations at Bakirang (E Sulawesi) in early 1980's, with up to 100 birds recorded on single morning; this site subsequently thought to have been abandoned, due to habitat disturbance and destruction, but birds returned by mid-1991, and c. 40 seen together in Dec 1991; conservation initiatives here include artificial hatchery and protection of breeding grounds; colony may well manage to survive, and may be suitable as site for ecotourism. Throughout range, egg-collecting carried out by villagers, in many cases on excessive scale; intensive illegal egg-collecting by workers of rattan company, illegally working in protected forest of Dumoga-Bone National Park; habitat loss and fragmentation, overexploitation of eggs and general human population pressure all increasing; some predation by village dogs. Species is subject of major conservation project, with backing of ICBP, WWF, PHPA (Indonesian Nature Conservation Department) and University of Amsterdam; tasks include surveys of old and new sites and major public awareness campaign. Survey work should be continued and augmented; many populations require active management, with involvement of local people, and public campaigns of environmental education; preservation and management of habitat also necessary; more artificial hatcheries should be developed. Species protected by Indonesian law. Successfully bred in captivity at New York Zoological Society's Wildlife Survival Center (Georgia, USA) in 1988 and 1990.

Bibliography. Andrew & Holmes (1990), Argeloo (1992a, 1992b, 1992c), Baltzer (1990), van den Berg & Bosman (1986), Collar & Andrew (1988), Dekker (1988b, 1990b, 1993), Dekker & Argeloo (1992), Dekker & Brom (1990), Dekker & Wattel (1987), Holmes (1989), Indrawan (1992), King (1978/79), Kobayashi & Gurnaya (1993), MacKinnon (1978, 1981), Pramono (1991), Rifai & Soehjar (1976), Rozendaal & Dekker (1989), Sasaki *et al.* (1982), Stark (1988), Tarmudji (1978), Watling (1983), White & Bruce (1986), Winn (1992), Zieren (1985).

Genus EULIPOA Ogilvie-Grant, 1893

9. Moluccan Scrubfowl

Eulipoa wallacei

French: Mégapode de Wallace **German:** Molukkenhuhn **Spanish:** Talégalo de Wallace
Other common names: Wallace's Scrubfowl

Taxonomy. *Megapodius wallacei* G. R. Gray, 1860, east Halmahera.

Often included in genus *Megapodius*, but plumage fairly different from that of rather uniform members of that genus; secondaries said to be shorter than primaries in present species, but of equal length in *Megapodius*; breeding habits differ from those of most members of *Megapodius*. Monotypic.

Distribution. Moluccas, from Halmahera S to Buru and Seram; Misool I (off NW New Guinea).



Descriptive notes. c. 30 cm. Small size; has median and greater upperwing-coverts and feathers of mantle reddish tipped grey; greyish underparts contrast with white undertail-coverts; bill bluish grey to whitish, legs and feet dark olive.

Habitat. Forested areas in hills and mountains at 700-1950 m, occasionally inhabiting lowland forest, e.g. on Misool; comes down to coast to lay eggs in sandy beaches. In areas of sympatry, occurs at higher altitudes than *M. freycineti* or *M. reinwardti*. May be largely restricted to limestone habitats on Halmahera. On Seram occurs in undisturbed forest, but

recorded in coastal scrub; thought to be less tolerant of disturbance than *M. reinwardti*.

Food and Feeding. No information available.

Breeding. Laying Sept-Dec on Buru; Oct-Apr on Haruku. Communal burrow-nester, using solar-heated beaches; also thought to be parasitic, and even said to build mounds. Comes down by night to lay eggs in communal laying beaches.

Movements. Large communal nesting grounds on Haruku receive many birds flying in over sea at night, probably from nearby S Seram. Recorded only once on Misool I (off NW New Guinea), when two birds collected; some suggestions that these might have been vagrants.

Status and Conservation. RARE. Mace-Land: Endangered/Critical. Total population may number c. 10,000 individuals; declining. Main threat is overexploitation of communal laying sites, and

any colony could be wiped out by lone collector in single season; also suffering degradation and conversion of habitat throughout range. Large communal laying site on Haruku (off S Seram) estimated in 1991 to be used by as many as 4000-5000 pairs yearly; still protected by local tradition, with strictly controlled harvesting (see page 297). In contrast, communal laying site at Amahai (S Seram) used by increasingly fewer birds, as villagers take eggs indiscriminately; also habitat destruction here, with removal of gravel and sand for roads. Only one bird seen in two month survey of Manusela National Park, C Seram, in 1987. Said still to be common on Buru, but confirmation of this required. Rare on Halmahera; probably extinct on Ambon and Ternate. Extensive surveys required, along with monitoring of populations and intensive general research on species; public campaigns of environmental education also highly desirable. Protected by Indonesian law. Eggs successfully hatched at Jakarta Zoo, Java.

Bibliography. Bowler & Taylor (1989), Collar & Andrew (1988), Dekker (1991a), Holmes (1989), Ripley (1960, 1964), Wallace (1860), West *et al.* (1981), White & Bruce (1986).

Genus *MEGAPODIUS* Gaimard, 1823

10. Polynesian Scrubfowl

Megapodius pritchardii

French: Mégapode de Pritchard **German:** Pritcharduhn **Spanish:** Talégalo de las Tonga
Other common names: Niufo'ou/Pritchard's/Tongan Scrubfowl/Megapode

Taxonomy. *Megapodius Pritchardii* G. R. Gray, 1864, Niufo'ou, Tonga.
Monotypic.

Distribution. Niufo'ou I (NW Tonga). Introduced to Tafahi I (NE Tonga), but this population has apparently died out; recently introduced to Late I and Fonualei I (NC Tonga).

Descriptive notes. c. 30-35 cm. Generally dark slaty grey, with short whitish crest; lower back, rump and wings washed reddish brown; white patch at base of primaries and white uppertail-coverts, both individually variable, and usually concealed; underparts grey, generally paler on belly. Bill yellow, iris brown, legs and feet bright yellow. Female has slightly paler legs. Juvenile generally duller, with brown and black barring; lacks white wing patch; has brownish iris and brownish orange legs and feet.

Habitat. Forages mainly in forested areas or thickets. Lays on beaches of crater lakes, in open patches of volcanic ash near vents or in dense forest along crater rim; prefers steeply sloping wooded areas, especially inner slopes of caldera, with large amounts of loose volcanic ash, perhaps because most of flat ground more subject to human disturbance and has less substantial vegetation cover; also rather bare cinder slopes on inside of caldera, and even on large island in centre of crater lake; small numbers said to breed on shores of SW coast of Niufo'ou, but this report has been challenged.

Food and Feeding. Mainly animal food. Prey identified by field observation included 53% insects, 25% land snails, 13% centipedes and 9% worms; most of prey much smaller, and so unidentified; also seen feeding on small amounts of fallen *Syzygium* fruit, though possibly only removing insects. Much time spent searching for food by scratching around in fallen leaves and other plant litter, or throwing it aside to reveal food. Often forages in pairs, both birds remaining fairly close together; male frequently offers food to female (see page 286).

Breeding. Apparently all year round, with peak in Apr-May. Burrow-nester, using geothermal sites. Egg burrows c. 90-150 cm long, c. 15-20 cm wide; information from local people suggests that up to 12 eggs can be laid in same burrow during c. 2 weeks. Incubation 47-51 days, in soil temperature of 29°-38°C. Newly-hatched chicks measured 12-13.5 cm in overall length, and weighed 40-51 g. Captive chicks did not try to find food until 4-5 days after hatching; at 6 days old, recognized ants, small insects and worms, and pecked at them.

Movements. Presumably sedentary. Only evidence of displacement is presence of birds breeding on island in midst of crater lake. Niufo'ou lies c. 200 km from nearest land, and c. 1500 km from nearest extant population of megapodes, in Vanuatu; huge distances involved and absence otherwise of megapodes from Vanuatu in historical times suggest species not equipped to perform successfully any movements away from Niufo'ou.

Status and Conservation. VULNERABLE. Mace-Lande: Endangered. Total population numbers only 400-800 individuals; considered to be stable. In 1976, estimated 820 birds in study area of 500 ha; extrapolated for total area of suitable habitat (c. 1500 ha) to give carrying capacity for whole island of c. 2500 individuals; still quite common in undisturbed forest, of which under 10 km² remain; some previous estimates as low as c. 200 birds. Niufo'ou is active volcanic island of c. 55 km², of which crater lakes comprise c. 18 km²; apparently species almost wiped out by volcanic eruption in 1886. Main threats are intensive egg-collecting and predation by feral cats. Legally protected, but in practice no enforcement; over 100 eggs can be taken annually at each breeding site; roughly one third of all sites surveyed in 1976 abandoned by 1990; most laying sites survive due to inaccessibility; very limited hunting of adults. Cats ambush females when they emerge from laying burrows, and remains of 7 birds found around one burrow; introduced rats and pigs may also pose serious threats; some natural predation by Barn Owls (*Nyctale*). Niufo'ou recently chosen by government of Tonga as potential site for crude oil storage depot; such a development would almost certainly lead to extermination of species, but project now likely to be abandoned. Current research concerns behaviour, habitat requirements and population size. Conservation measures proposed include attempts to establish additional populations on other islands in Tonga, as insurance against extermination or decimation of Niufo'ou population; attempts initiated on Late and Fonualei in 1993, with some initial success; introduced to Tafahi I (NE Tonga) in 1968, but apparently died out. Population requires monitoring; introduced predators should be eradicated; intensive general research on species necessary; public campaigns of environmental education also highly desirable. Only 2 birds known to be **found in captivity.**

Bibliography. Collar & Andrew (1988), Curio (1992), DuPont (1976), Friedländer (1899), Hay (1986), Lister (1911), Mayr (1938), Pratt *et al.* (1987), Rinke (1986a, 1986b, 1991), Steadman (1991, 1992a, 1993), Todd (1983), Watling (1982), Wei (1973), White & Bruce (1986), Ziswiler (1970).

11. Micronesian Scrubfowl

Megapodius laperouse

French: Mégapode de La Pérouse **German:** Lapérousehuhn **Spanish:** Talégalo de las Marianas
Other common names: Palau Scrubfowl (*senex*); Mariana Scrubfowl/Scrubhen (*laperouse*)

Taxonomy. *Megapodius La Pérouse* Gaimard, 1823, Tinian Island, Mariana Islands.

Linked with *M. layardi* in past. Race *senex* sometimes considered full species, mainly due to geographical isolation and differences in size and normal breeding habits. Two subspecies recognized.

Subspecies and Distribution.

M. l. laperouse Gaimard, 1823 - N Mariana Is.

M. l. senex Hartlaub, 1867 - Palau Is.



Descriptive notes. c. 28-30 cm. Smallest megapode. Short pale grey crest; iris brown, chestnut or golden yellow; legs yellow to brownish yellow. Gular skin may be brighter red in male than in female. Race *senex* smaller.

Habitat. Race *laperouse* occupies mainly forest in limestone areas, sometimes in hills, but also commonly found in coconut groves; other habitats include coastal scrub and thickets fringing beaches. Race *senex* found inland on large islands, affecting forest on deep soil or sharp rocky ridges with little soil; also in habitats small, raised limestone islands; breeds in strand forest behind sandy beaches; has

been recorded in limestone forest, at c. 50 m above sea-level.

Food and Feeding. Forages in soil and leaf litter on forest floor; usually in pairs.

Breeding. Burrow-nester and mound-builder, depending on race. Burrow-nester (*laperouse*), using geothermal and solar-heated sites, with burrows dug in cinder soil; on Agrihan I, said to scratch up fairly large mounds of volcanic soil 300-400 cm wide x c. 67 cm high, into which it digs egg burrows; nominate race may be mound-builder too, especially on large coral islands of S, where geothermal heat unavailable. Mound-builder (*senex*), making mounds from leaf litter and sometimes sand. On some small islands, pairs apparently territorial, at least for part of year. Chick dark sepia brown.

Movements. Irregular, but relatively frequent, presence of birds on small, barren volcanic islands indicates that colonization occurs, either naturally or due to intervention of people. In Palau Is, known to fly between islands, sometimes crossing several kilometres of sea; probably capable of flying between neighbouring islands fairly regularly, particularly for purposes of egg-laying.

Status and Conservation. RARE. Mace-Lande: *laperouse* endangered; *senex* vulnerable. Total population of *laperouse* numbers only 1000-2500 individuals; that of *senex* probably numbers c. 1000-10,000 individuals; both thought to be stable, although populations require monitoring. Race *laperouse* formerly abundant, at any rate on larger islands; during 19th century extirpated from Guam, Tinian and Rota. Largest numbers survived on Saipan (Marianas), but extirpated by 1930's, due to intensive hunting; reintroduced in 1960's, and small numbers survive, but apparently declining. Survives on small, uninhabited coral island of Aguijan; also thought to survive on all or most of the nine small, remote volcanic islands further N, most of which are also uninhabited, but some have very little suitable habitat; Guguan I may hold up to 2000 birds, and Sarigan I a few 100's. Populations on uninhabited islands thought to be relatively safe, but habitat preservation, control of introduced predators and strict enforcement of laws essential. This race has suffered from egg-collecting, loss of habitat to urban development, and also introduced predators; problems caused by feral pigs and monitor lizards on Saipan, and goats on Aguijan, although extent of impact unknown; extensive habitat destruction on larger islands of S for sugar cane plantations. Legally protected, but traditional exploitation of birds and eggs by indigenous people permitted. Four small islands of N (Guguan, Asuncion, Maug and Farallon de Pajaros) are Wildlife Sanctuaries. Much work needed on ecology of species; possible conservation initiatives include creation of artificial breeding grounds on some of larger islands of S. Race *senex* locally common on limestone islands and outlying islands, e.g. Kayangel Is; rare on larger, volcanic islands, and already exterminated from three. Egg-collecting more intensive and far-reaching in recent years, as facilitated by use of speed boats from 1970's. Habitat damaged by growing human population in some areas, but in mid-1970's reported still to be relatively intact on many islands. Effects of introduced predators uncertain: e.g. crab-eating macaque (*Macaca irus*) numerous on Angaur I, as is wild pig (*Sus scrofa*) on Babelthup I. Legal protection, but little enforcement, if any. Species occurs on some of Ngerukewid Is, very small islands which have been wildlife sanctuary since 1958; recent survey found species to be common here, occurring at 29% of forest stations; presence noted on nine separate small islands: total population of Ngerukewid and Kmekumer Is estimated at c. 60-90 birds. Uncommon on Peleliu and Angaur; status on Saipan (Palau) unknown. Immediate requirements include survey to establish main breeding grounds. No birds of either race known to be held in captivity.

Bibliography. Baker (1951), Collar & Andrew (1988), Enghring & Pratt (1985), Falanruw (1975), Glass (1988), Hay (1986), Jenkins & Aguon (1981), King (1978/79), Lemke (1984), Lister (1911), Ludwig (1979), Marshall (1949), Mayr (1938), Owen (1977), Pratt & Bruner (1978), Pratt, Bruner & Berrett (1979, 1987), Pratt, Enghring *et al.* (1980), Steadman (1992b), Stinson (1989), Stinson & Glass (1992), White & Bruce (1986), Wiles & Corry (1990), Wiles *et al.* (1987).

12. Nicobar Scrubfowl

Megapodius nicobariensis

French: Mégapode des Nicobar **German:** Nikobarhuhn **Spanish:** Talégalo de Nicobar
Other common names: Nicobar Scrubhen/Megapode; North Nicobar Megapode (*nicobariensis*); South Nicobar Megapode (*abbotti*)

Taxonomy. *Megapodius nicobariensis* Blyth, 1846, Nicobar Islands.

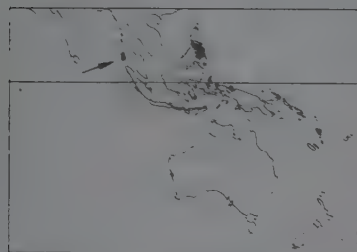
Formerly included in *M. freycinet*. Generally considered to form part of the *M. freycinet* super-species; apparently very close to *M. cumingi*. Two subspecies recognized.

Subspecies and Distribution.

M. n. nicobariensis Blyth, 1846 - C & N Nicobar Is, except Chauri and Car Nicobar.

M. n. abbotti Oberholser, 1919 - Great & Little Nicobar Is.

Descriptive notes. 43 cm; male 595-964 g, female 850-1021 g. Rather similar to *M. cumingi*, but considerably browner below and paler, with legs and feet greenish brown to red. Immature has head and neck brown and lacks red facial skin; underparts mostly rufous brown. Race *abbotti* darker above and below.



Habitat. Occurs in dense forest undergrowth. Breeds at highest densities along coast, especially by sandy beaches just above the high tide mark; sometimes further inland.

Food and Feeding. Snails, seeds, other plant matter, insects, etc.; species recorded include *Scarus plicatus* and *Helicina celebori*. Also ingests sand and pebbles to help grind down food. In captivity, chicks raised on termites. Feeds noisily in pairs or family groups.

Breeding. Breeding can occur more or less all year round. Monogamous. Mound-builder; builds mound of sand, leaves and plant matter, up to 150 cm high and over 10 m wide; some

mounds lower and flatter, built against buttresses of large living trees, or against, around or under rotting tree stumps. Up to 20 eggs found in one mound, possibly laid by several females; average of 2 pairs per mound; one record of two eggs laid at interval of 9 days. Chicks uniform snuff brown.

Movements. Presumably sedentary.

Status and Conservation. RARE. Mace-Land: *nicoabariensis* vulnerable; *abbotti* safe/vulnerable. Total population of race *nicoabariensis* could number 100-10,000 birds, but real numbers and trends unknown. Total population of race *abbotti* reckoned to number 2000-8000 birds; apparently stable. Until late 1980's and early 1990's, virtually no information available on species; in recent decades regularly said to be fairly common, but subsequently thought to be seriously endangered; main population, on Great Nicobar, was estimated to comprise under 400 birds in 1988, mostly along N coast; pressure from predation, egg-collecting and habitat destruction said to have increased in places in conjunction with economic development of islands; now extinct on Kunduli. Recent survey of Great Nicobar indicates species more common than was thought; in Mar 1992, stretch of 26 km of coast found to hold 39 active mounds and c. 78 pairs; extrapolation for whole island suggests minimum of c. 780 pairs actively breeding at time of survey; probably over 2000 birds on Great Nicobar alone; two national parks declared in 1992, covering 536 km² of island, more than 80% of which is covered with undisturbed primary forest. Evidence suggests that predation of eggs by man and monitor lizards (*Varanus salvator*) may be on relatively insignificant scale. On Great Nicobar, traditionally hunted by Shompene people; large population of E coast said to have been virtually wiped out by late 1980's, due to intensive and more efficient hunting by immigrant workforce, brought in for road construction. Main threat may be introduced predators, which should be eradicated. All recent information refers to Great Nicobar; extensive surveys of other islands required. Nominative race has long been said to occur to N, in Cocos Is., and perhaps to S, in Little Andaman Is., although good evidence lacking. No birds of either race known to be held in captivity at present.

Bibliography. Ali & Ripley (1980), Collar & Andrew (1988), Dekker (1992), Grimmett (1988), Mayr (1938), White & Bruce (1986)

13. Philippine Scrubfowl

Megapodius cumingi

French. Mégapode des Philippines **German.** Philippinenhuhn **Spanish:** Talégalo Filipino
Other common names: Tabon (Scrubfowl), Philippine Megapode

Taxonomy. *Megapodius Cumingii* Dillwyn, 1853, Labuan Island. Formerly included in *M. freycinet*. Generally considered to form part of the *M. freycinet* super-species; apparently very close to *M. nicoabariensis*. Population of Mindanao frequently placed in possible race *tabon*, but affinities of these birds uncertain; race *dillwyni* sometimes used for birds of N Philippines. Birds of Sulawesi were allocated distinct race *gilbertii*, but not reliably distinguishable from nominate race; race *bulukensis* described from Bulukbuluk I (SW of Mindanao), but validity very dubious. Three subspecies recognized.

Subspecies and Distribution

M. c. pusillus Tweeddale, 1878 - N & E Philippines.

M. c. cumingii Dillwyn, 1853 - N Borneo, Sulawesi, SW Philippines.

M. c. sanghirensis Schlegel, 1880 - Sangihe Is., Talaud Is.



Descriptive notes. 32-38 cm. Virtually no crest; iris brown, legs brownish to blackish. Rather similar to *M. nicoabariensis*, but much darker, and generally greyer below. Juvenile similar to adult, but with much more extensive feathering around eye. Races separated mainly on tones of coloration and size; *sanghirensis* larger, with upperparts much redder brown and underparts darker grey.

Habitat. Forested zones of hills and mountains at 250-2000 m; also beach forest and coastal scrub on small islands. In Philippines, mainly breeds near seashore, but occasionally recorded fair distance inland.

Food and Feeding. Known to feed on variety of larval and adult insects; worms and snails also recorded.

Breeding. Probably breeds all year round; in N Sulawesi laying in Mar, Nov and Dec; in Philippines breeding in May (Fugal), Jun-Aug (Palawan), Aug (Negros) and Dec (Calayan). Mound-builder in N Borneo and most of Philippines; burrow-nester in Sulawesi and parts of Philippines (Palawan, Negros, Panay), using decaying tree roots or stumps and solar-heated beaches. Several pairs may share same mound, sometimes shares burrows of *Macropygia*; egg-burrows can be 50 cm long or more. Chicks reddish-brown, with barring on back and wings.

Movements. No movements recorded, but periodical presence on small onshore islets indicate that some short sea crossings must occur. Like *crepitans*, generally escapes from danger by running fast through thick undergrowth, sometimes after short ground flight.

Status and Conservation. Not globally threatened. Mace-Land: Vulnerable. Total population might number c. 10,000-100,000 individuals, but apparently declining. Currently considered near-threatened. Formerly widespread, but now local and generally uncommon in Philippines, where suffers from egg-collecting, e.g. on Negros; also some hunting pressure. Few records from mainland Borneo in Sabah, now scarce here and on islands off N Borneo, due to excessive exploitation. In N Sulawesi, probably common in Danau Tana National Park, in early 1980's was common in Tana Toraja National Park, but has declined in recent years, probably due to illegal logging, and now only seen rarely, deep into primary forest, quite common in N Sulawesi in

early 1980's; potential threats in Sulawesi include habitat loss and increasing human population pressure. Main threats are overexploitation for food, degradation and conversion of habitat, and effects of introduced predators. Conservation requirements include extensive survey work, environmental education campaigns, management of habitat and designation of a series of protected areas. Legally protected in Indonesia. No birds known to be held in captivity.

Bibliography. Andrew & Holmes (1990), Bishop (1992), Dickinson *et al.* (1991), Holmes (1989), Lambert (1993), MacKinnon & Philipps (1993), Mayr (1938), Rabor (1977), Rozendaal & Dekker (1989), White & Bruce (1986).

14. Sula Scrubfowl

Megapodius bernsteinii

French: Mégapode de Bernstein

German: Sulahuhn

Spanish: Talégalo de Sula

Taxonomy. *Megapodius Bernsteinii* Schlegel, 1866, Sula Islands.

Formerly included in *M. freycinet*. Generally considered to form part of the *M. freycinet* super-species. Birds from Peleng I (Banggai) have been accorded separate race *perrifus*, but observed differences in overall plumage tones usually attributed to individual variation; this race has alternatively been assigned to *M. reinwardti*, presumably in error. Monotypic.

Distribution. Sula and Banggai Is.



Descriptive notes. c. 35 cm. Fairly uniform plumage. Differs from *M. cumingii* in having underparts similar to upperparts; chestnut lower back, rufous lower breast and belly, legs and feet orange or red.

Habitat. Variety of habitats, ranging from primary forest to coastal scrub. On Lalolo I (Banggai Is.), recorded as high as 450 m above sea-level; also heard in mangroves and in thickets in a coconut plantation. On Taliabu I (Sula Is.), not recorded in primary montane forest, but quite common in primary and selectively logged lowland forest, up to 250 m; fairly frequent in wooded savanna and around

margins of agriculture, where can occur in dense scrub. Limited evidence may suggest some degree of adaptability to disturbed habitats; however, this could simply reflect apparent preference for lowlands, where vast majority of logging takes place.

Food and Feeding. Insectivorous. Frequently forages in areas with fallen and rotting trees and branches.

Breeding. Eggs and 1 chick found in Dec, indicating laying from Oct or earlier; active mound in Sept/Oct. Apparently monogamous. Mound-builder. Mounds often built round rotting bases of trees; one mound was c. 100 cm high x 600 cm wide. Eggs said to require 2 months minimum for hatching.

Movements. Presumably sedentary. Frequently seen in pairs, sometimes in groups of up to 5 birds.

Status and Conservation. VULNERABLE. Mace-Land: Vulnerable. Total population roughly estimated to number c. 10,000 individuals, but numbers may be much higher; thought to be stable or declining. Until recently unknown in wild, with no records of any sort since 1938; in 1981, recorded on Lalolo I, which appeared to be less disturbed than other main islands of Banggai group; 2 birds recorded on Mangole I (Sula) in 1988. In Oct-Dec 1991, project, with participation of Indonesian biologists, found species to be widespread in Banggai Is., where recorded on 7 of 8 islands surveyed; on Peleng I, common in some areas, absent in others; local people reported presence of species on several other, unsurveyed islands; conservative minimum estimate of 7000 birds for total population of Banggai Is., but species probably declining. On Taliabu I (Sula Is.), species relatively common in two study sites, but infrequent to absent in others; extrapolation of data gives rough estimate of total population of Taliabu at c. 22,000-54,000 birds, of which c. 4000-10,000 should occur in proposed reserve. Main threats appear to be habitat destruction, predation, and hunting and trapping by man; likely to be severely affected by large-scale commercial logging, especially of coastal forests, that is going on in Sula and Banggai Is.; egg-collecting does not seem to occur on Taliabu I, where predation of eggs by monitor lizards (*Varanus salvator*) recorded, although significance probably minimal; in Banggai Is., introduced feral Red Junglefowl (*Gallus gallus*) apparently displace present species in some areas. Proposal in 1981 by FAO/UN to create protected area of c. 700 km² on Taliabu I, largest of Sula Is.; this should now be put into practice, before area lost to commercial logging; other protected areas should be designated. Species protected by Indonesian law, but very little, if any, effective protection. Conservation proposals include public awareness campaign. No birds known to be held in captivity.

Bibliography. Collar & Andrew (1988), Davidson *et al.* (1992), Holmes (1989), Indrawan *et al.* (1992), Lucking *et al.* (1992), Mayr (1938), White & Bruce (1986), Yong (1990).

15. Dusky Scrubfowl

Megapodius freycinet

French: Mégapode de Freycinet

German: Großfußhuhn

Spanish: Talégalo de Freycinet

Other common names: Common Scrubfowl, Incubator Bird (*freycinet* superspecies); Geelvink Scrubfowl (*geelvinkianus*)

Taxonomy. *Megapodius freycinet* Gaimard, 1823, Waigao.

Forms superspecies with *M. nicoabariensis*, *M. cumingi*, *M. bernsteinii*, *M. crepitans*, *M. javanensis*, *M. affinis*, and *M. reinwardti*, all of which were formerly lumped together as races of present species. Race *geelvinkianus* may merit treatment as full species. Birds of N Moluccas sometimes awarded separate race, *quoyii*. Species said to hybridize with *M. reinwardti* on some islands in Geelvink Bay, where *M. reinwardti* apparently absent and also in S Moluccas (where present species not known to occur). Two subspecies normally recognized.

Subspecies and Distribution

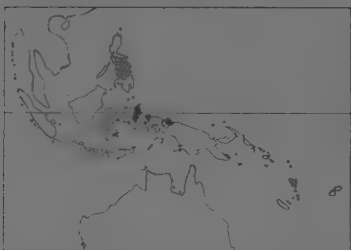
M. f. freycinet Gaimard, 1823 - N Moluccas, W Papuan Is.

M. f. geelvinkianus A. B. Meyer, 1874 - islands in Geelvink (Cenderawasih) Bay.

Descriptive notes. c. 35 cm. Uniform dark grey; shortish crest; with paler grey on bend of wing; legs and feet blackish to dark greenish olive or horn-coloured. Race *geelvinkianus* slightly paler.

Habitat. Occurs in mangroves and along margins of swamps, woodland and agro swamps, also in wet evergreen forest in lowlands, usually below 300 m; said to occur in limestone hill forests at c. 100-450 m on Halmahera; on Misol I breeds mangrove beaches or well inland.

Food and Feeding. Walks along forest floor, scratching in litter for insects, with constant clucking; pair can feed together.



mahera, but suffers intensive pressure from trappers. Elsewhere, recent sightings very scarce; single bird heard on Ternate in Jul 1989. Paucity of records suggest species could be approaching threatened status. Main threats are overexploitation for food, degradation and conversion of habitat, and effects of introduced predators; predation of young by indigenous *Accipiter henicogrammus* recorded. Extensive surveys required; some protected areas should be established in suitable habitat. Protected by Indonesian law. No birds known to be held in captivity.

Bibliography. Beehler *et al.* (1986), Bishop (1992), Holmes (1989), Mayr (1930, 1938), Ripley (1960, 1964), White & Bruce (1986).

16. Melanesian Scrubfowl

Megapodius eremita

French: Mégapode mélanésien **German:** Bismarckkuhn **Spanish:** Talégalo Eremita
Other common names: Bismarck Scrubfowl

Taxonomy. *Megapodius eremita* Hartlaub, 1867, Ninigo Islands.

Formerly included in *M. freycinet*. Generally considered to form part of the *M. freycinet* super-species. Known to hybridize with *M. affinis* on Karkar I (off NE New Guinea); comparison of specimens taken on Karkar I in 1914 and 1969 indicates that this population may have moved closer to present species than to *M. affinis*. Reported to hybridize with *M. reinwardi* in D'Entrecasteaux Is and Louisiade Archipelago, where present species not known to occur. Race *branchi* traditionally accepted for birds of Solomon Is (including Bougainville I and Buka I), but validity doubtful. Monotypic.

Distribution. Ninigo Group through Admiralty Islands, New Britain, New Ireland and rest of Bismarck Archipelago to Solomon Is.



Descriptive notes. c. 34 cm; 555-660 g. Very short crest; plumage very dark all over, generally greyish; grey on underwing extensive; forehead and part of face bare and reddish; legs and feet range from dark grey to olive green or horn-coloured.

Habitat. Rain forest in New Britain, occurring from sea-level up to at least 1500 m, but primarily in lowlands, apparently due to preference for deep soil, copious leaf litter and very sparse undergrowth; often in mesophyll vine forest; infrequent in swamp forest, hill forest and secondary growth, apparently due to heavy, waterlogged soils and dense under-

growth, or shallow soils with minimal leaf litter that typically cover limestone areas. On small islands, also forages in low, dense vegetation in open areas. Usually breeds at geothermal sites or on sandy beaches; at Liga, New Ireland, birds lay in school rubbish pits; in Solomon Is sometimes lays up to 10 km inland from coast.

Food and Feeding. Fruits and seeds; also crickets and other invertebrates. Searches around for arthropods and fallen fruit in leaf litter and amongst decaying branches.

Breeding. Laying Apr-Dec in W New Britain, with peak in Jun-Aug; apparently all year round on Savo I (EC Solomon Is). Communal burrow-nester, using geothermal sites (New Britain, Savo), solar-heated beaches (Admiralty Is), fallen, rotting trees (Bougainville I) and decaying matter between tree roots (E Solomon Is) or under bases of trees (Wuvulu I in Ninigo Is); also mound-builder (Ninigo Is, New Britain, E Solomon Is). On Savo eggs buried at depth of c. 88 cm, in sand temperature of 33°C; burrows average 40 cm wide by 90 cm long. Sample of 20 burrows studied at Garu (New Britain) for 6 weeks, during which production averaged 6-45 (4-11) eggs/burrow, but ratios of females/burrow and/or burrows/female unknown. Chick newly emerged from egg-burrow on Savo I measured 110 mm, with 310 mm wingspan.

Movements. In N New Britain, outwith breeding season (during rains) birds disperse extensively throughout forested areas, and may move mostly to S coast; birds seen flying across bay. Parties of birds sometimes fly out to small offshore islets at dusk; young birds, in particular, even fly into houses at night, apparently attracted by lights. Large numbers congregate at geothermal laying grounds; elsewhere, normally seen singly. High energy demands of egg-laying, together with huge concentrations at laying grounds, imply extensive dispersal into surrounding forests for feeding in between laying of successive eggs.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Total population may number 10,000-1,000,000 individuals; perhaps on decline. Widespread and fairly common on New Britain; seems to be less numerous elsewhere, although no recent information available from Solomon Is. Hundreds of burrows in thermally heated sand on Lou I, Admiralty Is, in 1970's. Largest known geothermal sites are in NC New Britain at Pokilli and Garu, covering respectively c. 707 ha and 67 ha; in 1970's, countless 10,000's of burrows at former, 11,776 recorded in partial count at latter; estimates in 1978 gave c. 2,000 birds at former and c. 53,000 at latter. Such vast concentrations highly vulnerable, particularly to habitat destruction and abusive levels of egg-collecting; latter still carried out by traditional landowners but currently on increase, traditional laws fixing sustainable levels of egg harvest for consumption and trading purposes now largely disregarded, with probably well over 1,000,000 eggs taken annually at Pokilli. Large colony at Matupit (NE New Britain) has suffered considerable human disturbance and damage, mainly through soil erosion. Breeding grounds also threatened by feral dogs, which kill adults and chicks, and also by pigs, which unearth eggs. In New Britain, steady growth of timber industry is major threat, as clear-felling removes foraging habitat, but areas of forest also cleared for agriculture; effects aggravated by ever-increasing human population; species apparently able to tolerate certain amount of selective logging of habitat. On Savo I (Solomons), c. 200 birds estimated to use laying grounds at one time in 1981; site plundered daily by local villagers, with no fixed quotas; species reported

Breeding. Birds calling and in breeding condition Oct-Dec in W Papuan Is; chicks in Jan on Misool I. Mound-builder. Perhaps also parasitic; said to lay in active mounds of *Eulipou wallacei* on Halmahera, although latter species not definitely known to build mounds. **Movements.** No information available. Presumably sedentary.

Status and Conservation. Not globally threatened. Mace-Lande: Safe; race *geelvinkianus* endangered. Total population may number 10,000-100,000 individuals; alternative estimate of under 5000 birds; thought to be stable or declining. Still common on Hal-

mahera, but suffers intensive pressure from trappers. Elsewhere, recent sightings very scarce; single bird heard on Ternate in Jul 1989. Paucity of records suggest species could be approaching threatened status. Main threats are overexploitation for food, degradation and conversion of habitat, and effects of introduced predators; predation of young by indigenous *Accipiter henicogrammus* recorded. Extensive surveys required; some protected areas should be established in suitable habitat. Protected by Indonesian law. No birds known to be held in captivity.

Bibliography. Beehler *et al.* (1986), Bishop (1978, 1980), Bishop & Broome (1979), Broome *et al.* (1984), Coates (1985), Harding (1982), Kisokau (1976), Mayr (1938, 1945), Meyer (1930), Pockley (1937), Roper (1983), Sibley (1946), Steadman (1991), Steadman *et al.* (1990), White & Bruce (1986), Wolff (1965).

17. Vanuatu Scrubfowl

Megapodius layardi

French: Mégapode de Layard **German:** Layardkuhn **Spanish:** Talégalo de Nuevas Hébridas
Other common names: Tristram's/New Hebrides Scrubfowl

Taxonomy. *Megapodius layardi* Tristram, 1879, Vaté, Vanuatu.

Formerly included in *M. freycinet*; alternatively linked with *M. laperouse*. Generally considered to form part of the *M. freycinet* super-species. Monotypic.

Distribution. C & N Vanuatu (New Hebrides) and Banks Is.



Descriptive notes. c. 30-34 cm. All dark brownish black; extensive pinkish red bare skin on forehead and face; iris brown, legs pale yellow. Juvenile duller, with brown legs. **Habitat.** Mostly found on floor of lowland forest or thicket; also occurs at medium altitudes. Normally breeds near coast.

Food and Feeding. Said to take insects, grubs, worms, snails and other invertebrates; also fruit, seeds and other plant matter. Scratches in damp leaf litter for food.

Breeding. Apparently breeds all year round. Burrow-nester, using decaying tree-roots and perhaps, where available, geothermal sites; possibly also mound-builder. Laying grounds vary in size: under 50 cm wide, where used by 1 female only; up to 10 m wide, where communal, with many burrows. Burrows 30-120 cm deep and up to 200 cm long. Incubation over 45 days; chicks pale brown with darker barring above.

Movements. Sedentary. Sometimes flies off to roost on offshore islets. Prefers to run rather than fly away from danger.

Status and Conservation. Not globally threatened. Mace-Lande: Vulnerable. Total population might number c. 10,000 individuals; thought to be stable or declining. Apparently still common in suitable habitat. Breeding grounds and general habitat threatened on some islands, e.g. Efate, due to encroachment of agriculture and other forms of development. Eggs have been collected on local scale for centuries, and much appreciated as source of protein. In past, only most accessible laying sites harvested, with insignificant effects on species as whole; increase in human population, combined with greater mobility, suggests effective protection required to ensure long-term survival of species. Some losses caused by introduced predators. Hunting permitted only Apr-Jun. Measures proposed include: establishment of reserves around major laying grounds; implementation of fixed quotas for egg-collectors; and stricter control of poachers. No birds known to be held in captivity.

Bibliography. Biggula (1992), Mayr (1938, 1945), Raethel (1988), Steadman (1991), Steadman *et al.* (1990), White & Bruce (1986).

18. New Guinea Scrubfowl

Megapodius affinis

French: Mégapode de Nouvelle-Guinée **German:** Neuguineahuhn **Spanish:** Talégalo Papúa

Taxonomy. *Megapodius affinis* A. B. Meyer, 1874, Rubi, New Guinea.

Formerly included in *M. freycinet*. Generally considered to form part of the *M. freycinet* super-species. Known to hybridize with *M. eremita* on Karkar I (off NE New Guinea). Formerly considered polytypic, with acceptance of races *jobiensis*, *decollatus* and *huonensis*. Name *affinis* may not be applicable to present species, in which case *M. decollatus* would have priority. Monotypic.

Distribution. N New Guinea and offshore islands, from Geelvink (Cenderawasih) Bay E to Huon Gulf, and as far S as Nassau Range, on S slopes of Snow Mts; exact limits of range uncertain in many areas.



Descriptive notes. c. 33 cm. Rather long crest; underparts vary from ashy grey to brownish olive; legs and feet dark olive green to blackish.

Habitat. Rain forest, occurring from sea-level up to 1800 m, and probably 2000 m; occupies, and breeds in, swamp forest along R Sepik (NC New Guinea). In Nassau Range (WC New Guinea), collected at 880 m and 1280 m, whereas *M. reinwardi* found at lower altitudes. In upland areas often sympatric with *Aepyodius arfakianus* and *Talegalla* (?*jobiensis*), sometimes breeding in close proximity.

Food and Feeding. No information available.

Breeding. Laying said to be all year round, with records from Feb, Mar/Apr and Oct (CN New Guinea); in S highlands (probably present species) Jan-May, dry season. Mound-builder. Mounds may apparently be used by up to 4 pairs; one mound said to have been used for c. 13 years; total of 28 eggs/chicks apparently taken from single mound in one year. This species thought to parasitize mounds of *Aepyodius arfakianus* and *Talegalla* (?*jobiensis*) (see page 290), although latter has also been claimed to parasitize mounds of present species.

Movements. No information available. Presumably sedentary.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Total population may number 10,000-1,000,000 individuals; thought to be stable. Widespread and common in Irian Jaya (W New Guinea). Found to be abundant in swamp forest along middle reaches of R Sepik in mid-1950's. Threats include degradation and conversion of habitat. Legally protected in Indonesia. No birds known to be held in captivity.

Bibliography. Beehler *et al.* (1986), Bergman (1963), Bishop (1978), Coates (1985), Dwyer (1981), Gillard & LeCroy (1966), Holmes (1989), Mayr (1938), Ripley (1964), White & Bruce (1986).

19. Orange-footed Scrubfowl

Megapodius reinwardt

French: Mégapode de Reinwardt **German:** Reinwardthuhn **Spanish:** Talégalo de Reinwardt
Other common names: Reinwardt's Scrubfowl; Tanimbar Scrubfowl (*tenimberensis*); Seram Scrubfowl (*forstenii*)

Taxonomy. *Megapodius Reinwardt* Dumont, 1823, Amboina; error = Lombok. Formerly included in *M. freycinet*. Generally considered to form part of the *M. freycinet* super-species. Very complex internal taxonomy, still poorly understood; recent research suggests possible elevation of race *forstenii* (incorporating *buruensis*) and reinstatement of race *tenimberensis* both to full species status. Validity of race *buruensis* has been questioned. Variation within Australian populations is slight and clinal, possibly warranting recognition of only one race, rather than three. Birds of Aru Is and those of New Guinea have been awarded separate races, respectively *aruensis* and *duperreyi*, but rarely accepted. Form *perrufus* of Peleng (Banggai Is) has been included in present species, but almost certainly belongs in *M. bernsteinii*, and in any case of dubious validity. Species said to hybridize with *M. freycinet* on some islands in Geelvink Bay (where present species apparently absent) and also in S Moluccas (where *M. freycinet* not known to occur); hybridization likewise reported with *M. eremita* in D'Entrecasteaux Is and Louisiade Archipelago (where *M. eremita* not known to occur). Eight subspecies currently recognized.

Subspecies and Distribution.

- M. r. buruensis* Stresemann, 1912 - S Moluccas, on Buru.
- M. r. forstenii* G. R. Gray, 1861 - S Moluccas, on Seram, Ambon, Haruku and Gorong.
- M. r. reinwardt* Dumont, 1823 - Lesser Sundas, extreme SE Moluccas, Aru Is and NW, S & SE New Guinea; possibly also islands of Torres Strait.
- M. r. macgillivrayi* G. R. Gray, 1861 - Trobriand, Marshall Bennett, Woodlark and D'Entrecasteaux Is and Louisiade Archipelago (off SE New Guinea); possibly also SE New Guinea.
- M. r. takimbarensis* P. L. Sclater, 1883 - Tanimbar Is.
- M. r. tumulus* Gould, 1843 - N Australia from Kimberley Division (NE Western Australia) to Melville I and N Northern Territory.
- M. r. yorki* Mathews, 1929 - Cape York Peninsula (N Queensland) and offshore islands, possibly including those of Torres Strait.
- M. r. castanonotus* Mayr, 1938 - EC Queensland (Cooktown to Yeppoon) and offshore islands.

Descriptive notes. 35-47 cm; male 851-1200 g, female 562-1200 g. Long crest; chestnut tinge on back; legs and feet orange to pinkish red. Female averages slightly smaller. Immature very similar to adult, but smaller, sometimes with paler head. Extensive local variation in size and colour; race *tenimberensis* shows less grey on mantle and paler grey below; race *forstenii* dark brown above, redder crown and shorter crest; race *buruensis* similar to *forstenii*, but slightly larger, with paler back; *tumulus* larger, darker and less olive.

Habitat. Rain forest and variety of other wooded areas, including swamp forest; sometimes ventures into more open areas, especially where habitat fragmented. Mostly in lowlands, but up to 1500 m in SE New Guinea and 1900 m on

Buru; in WC New Guinea occurs at lower altitudes than sympatric *M. affinis*. On Buru occurs in wooded areas with light undergrowth; breeds near coast and in hill forest. On Seram occurs in primary and secondary lowland forest, but also on small coral islets; highest densities recorded in scrubby secondary forest and coastal scrub; frequents similar habitat on Lombok, Sumbawa and Flores; on Sumba, usually found in fairly open forest. On Komodo, breeds in coastal woodland or scrub, or in similar habitat alongside dry riverbeds; mounds sometimes only c. 100-200 m from human habitation, though usually well hidden. In N Queensland (Australia), breeds in dense forest often along creeks, and frequently up to c. 50 km inland; sometimes breeds in clearings or near forest edge; also occurs in vine thickets. Even breeds on tiny, remote islands, e.g. Kakabia I (Flores Sea) and Mai I (Banda Sea).

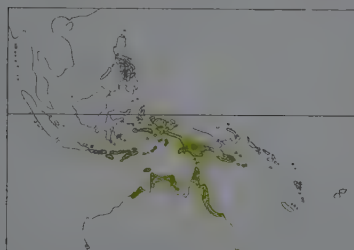
Food and Feeding. Mainly plant food, including seeds, berries and roots; also fruits, shoots and flowers; occasionally snails, worms, beetles and other insects and their larvae. Walks along, pausing at frequent intervals to rake about in leaf litter on forest floor; sometimes examines whole patch of leaf litter in great detail, leaving irregular piles of turned leaves behind.

Breeding. Mainly Jul-Mar in NE Australia; peaks Nov-May in SE New Guinea, during and shortly after rains; eggs Feb-Mar on Buru, May on Seram, probably Aug-Nov on Komodo, and virtually all year round on Flores; chicks in Jun on Mai I. Monogamous. Mound-builder; occasionally burrow-nester, using heat from sun or possibly even rotting tree-roots. On Komodo, sample area of 250 ha contained 42 mounds, of which 23 active; minimum distance between active mounds c. 100 m. Mound built by both sexes of leaves, sticks, earth or sand, and general debris; often roughly circular or elongated; sometimes very large, on Komodo averaging 95 cm high x 715 cm wide, and containing c. 20 m³ of material, but in Australia some mounds much larger (see page 287); mound temperature c. 29°-38°C during incubation. Usually built on flat or slightly sloping ground, mostly in shade. Mounds may be used successively or simultaneously by different pairs, but these always work independently; often used regularly over many years, e.g. 1 pair used same mound for almost 5 years; same mound used for 8 years by total of 4 pairs, occupation starting and stopping outwith study period. Single female recorded laying 12-13 eggs, each at interval of 9-20 days, during period of c. 20 weeks; incubation period unknown, although said to be c. 70 days. Chick dark brown, with rufous barring above, and centre of belly buff.

Movements. Occurrence on offshore islands and in isolated patches of forest indicates capability of covering fair distances in flight. Usually seen in pairs; when alarmed, prefers to walk or run away or fly short distance into tree.

Status and Conservation. Not globally threatened. Mace-Lande: Safe; *forstenii* (incorporating *buruensis*) safe; *tenimberensis* vulnerable. Total population may number c. 100,000-1,000,000 individuals; generally stable. Widespread and common within Indonesian range; fairly common in parts of Flores and Sumbawa. Well adapted to secondary growth; in places, species exterminated by excessive human pressure, but has subsequently managed to recolonize. On Komodo suffers frequent predation of eggs by Komodo dragon (*Varanus komodoensis*). In Australia, uncommon to common and with some local increases, e.g. around Darwin; generally more common in areas remote from human activities and disturbance; superabundant on Deliverance I in Torres Strait; suffers some egg predation by pigs and goannas. Legally protected in Indonesia. No birds known to be held in captivity. Race *forstenii* (incorporating *buruensis*) could number 10,000-100,000 birds, and apparently stable; on Seram, moderately common in Manusela National Park in 1987, where apparently more capable of tolerating disturbance than *Eulipoa wallacei*, and recorded mainly in secondary forest and coastal scrub. Race *tenimberensis* may number 1000-10,000 individuals; thought to be stable or on decline; threats include overexploitation for food, degradation and conversion of habitat, and introduced predators; protected areas should be established.

Bibliography. Beechler *et al.* (1986), Bergman (1963), Bishop (1978, 1992), Bowler & Taylor (1989), Bruce (1987), Coates (1985), Crome & Brown (1979), Holmes (1989), Lincoln (1974), Lindsey (1979), MacKinnon & Phillips (1993), Marchant & Higgins (1993), Mayr (1930, 1938), Mees (1982), Stone (1991), White & Bruce (1986).



Class AVES

Order GALLIFORMES

Suborder CRACI

Family CRACIDAE (CHACHALACAS, GUANS
AND CURASSOWS)

- Medium-sized to large long-tailed gallinaceous birds with predominantly arboreal habits.
- 42-92 cm.



- Neotropical Region and extreme S Nearctic.
- Forests, open woodlands and scrub, from sea-level up to 3900 m.
- 11 genera, 50 species, 88 taxa.
- 13 species threatened; none definitely extinct since 1600.

Systematics

Cracids are a group of ancient origin. The oldest fossil attributed to the family dates to the Middle Eocene, at least 50 million years ago, and was found in Wyoming, USA. The find was of a small, not particularly specialized cracid, and, judging from its limb proportions, it was definitely arboreal. Various other fossils also found in North America show that cracids very similar to the present day chachalacas (*Ortalis*) have existed at least since the Upper Oligocene. In South America, much more recent fragments of *Crax* and *Penelope*, dating from about 20,000 years ago, have been found in cave deposits from the Pleistocene of Brazil.

Although there are some fossil remains from the Old World that have been tentatively attributed to this family, all the living species are found in the Neotropical Region, although a few penetrate the extreme south of the Nearctic Region. Taking into account the distribution of the present day species and also the fossil register, it seems most likely that the family originated during the early Tertiary in Central America and perhaps southern North America, which at that time had tropical or subtropical conditions, at least as far north as Wyoming. Once they arrived in South America, probably long before the Pleistocene, they diversified more quickly, as is to be expected in a larger area. In support of this theory is the fact that the greatest diversity among present forms is to be found in north-western South America.

The cracids have been considered the most primitive family in Galliformes. Some anatomical similarities indicate a close relationship with the megapodes, which are also highly distinctive and primitive. It is interesting to note that Megapodiidae and Cracidae are mainly restricted to the Australasian and Neotropical Regions respectively, where other galliform birds, including the most typical representatives of the order, are poorly represented.

The distance between the cracids and other Galliformes is illustrated by the fact that, in spite of a few erroneous reports to the contrary, no cracid has ever been known to hybridize with a member of another family, whereas there are numerous such cases between turkeys, grouse, pheasants and guinea fowl. In addition, cracids constitute the only largely arboreal family in the order, with even the most terrestrial species nesting,

roosting, singing and sometimes feeding in trees, often at considerable height. This suggests that, contrary to what might be imagined, the ancestral Galliformes may have been arboreal, and the cracids their closest descendants; within the family, some of the apparently most highly evolved forms are those which have developed the most terrestrial habits. Another difference between the cracids and the typical families of the Galliformes is their small clutch size of only two, three or, at most, four eggs.

All these differences and others, especially those of anatomy, explain why the cracids have traditionally been separated at the suborder or superfamily level, either alone or with the megapodes. C. G. Sibley and J. E. Ahlquist, following up their important work on DNA-DNA hybridization, even proposed a



Subdivision of the
Cracidae.

[Figure: Francesc Jutglar]

The race grayi of the Blue-throated Piping-guan is one of the six forms currently included in the genus *Pipile*. This group provides an excellent example of the substantial controversy that besets the internal taxonomy of the Cracidae. In the second half of the twentieth century alone, different authors have considered all six forms to constitute a single species, or two, three, four, five or six separate species. Furthermore, their isolation in the genus *Pipile* is not unanimously accepted: they have been included in the normally monotypic genus of the Wattled Guan (*Aburria aburri*), or alternatively merged with the typical guans in *Penelope*; at the other extreme, some workers reckon them sufficiently distinct from *Penelope* to justify their separation in a different tribe.

[*Pipile cumanensis grayi*, south-east Peru.

Photo: J. C. Muñoz/Incafo]



new order, Craciformes, in which the cracids and megapodes would be included, in separate suborders. However, the more traditional treatment, followed here, places them together with the megapodes in the suborder Craci of Galliformes.

The internal taxonomy of the family presents numerous controversial cases, in terms of the validity of species, the assignation of genera, or even the grouping of genera into tribes or subfamilies. Proof of this is that the three most important recent reviews of the family reached many contradictory conclusions at all of these levels; these studies, by F. Vuilleumier, C. Vaurie, and J. Delacour and D. Amadon, were all published between 1965 and 1973.

The family can be divided into three easily identifiable natural groups: the chachalacas, the guans and the curassows. The first two are very similar taxonomically, so much so that the grouping of the chachalacas (*Ortalis*) and the typical guans (*Penelope*) into a single genus has been suggested. However, this extreme proposal is less apt, if all the differences are taken into account, including those in calls, displays and ecology. Therefore, the most suitable option is probably to divide the family into two subfamilies, with the chachalacas and all the guans in Penelopinae, and the curassows in Cracinae; these two groups have normally been labelled as tribes, in an attempt to show that the differences are slight, but systematic procedure insists that families be divided into subfamilies, and subfamilies into tribes. The Cracinae differ from the Penelopinae in the proportionally longer pelvis, the morphology of the heavier, larger bill, and larger size; the first and third of these features tie in with their more terrestrial habits.

The distinctive Horned Guan (*Oreophasis derbianus*) is a special case. While obviously a guan, especially on carriage and behaviour, so included in Penelopinae, it shows some affinities with the curassows. Its large size, its red "horn" and its "mooring" call suggest that it could be some sort of a link between the two groups. This, and some unique characteristics, such as the overall coloration, the bare crown and horn and the feathered base of the bill concealing the nostrils, explain why some authors would award it a separate subfamily, Oreophasiinae, or at least its own tribe.

The chachalacas (*Ortalis*) are normally considered to constitute the most primitive genus in the family, due to their small size, plain coloration and lack of dewlaps and wattles. However, the fact that they prefer more open habitats, while all other cracids are forest birds, and the fact that they come to the ground more often than the guans, might indicate that they are actually derived from the guans. In such a case, the smaller size and duller colouring of the chachalacas could be interpreted as adaptations to their habitat.

It is a notably homogeneous genus of 12 species, or anything from six to 17, according to different authors. All of the species are so similar that it would be difficult for any two of them to compete in the same area, and as a result they are all allopatric, with ranges that do not overlap; it has even been suggested that the entire genus constitutes a superspecies. There are a few possible exceptions, mainly in Chiapas, southern Mexico, where the Plain Chachalaca (*Ortalis vetula*), the West Mexican Chachalaca (*Ortalis poliocephala*) and the White-bellied Chachalaca (*Ortalis leucogastra*) all meet, perhaps with a



slight overlap. In these circumstances, differences in voice may play an important role as a segregating mechanism, although in these small areas of contact there seems to be a tendency towards ecological separation. For instance, where the West Mexican Chachalaca coincides, in the northern limit of its range, with the Rufous-bellied Chachalaca (*Ortalis wagleri*), and in the south, with the Plain Chachalaca, it occupies moister woodland at higher altitudes than the other species. In contrast, in the rest of its range, where it is the only chachalaca present, it can also be found in somewhat drier habitats and at lower altitudes.

Another area where it is said that two species of chachalacas overlap is north-west Jalisco, in central Mexico, where a series of up to eight possible hybrids between the Rufous-bellied Chachalaca and the West Mexican Chachalaca were reported. This led to the two forms being considered conspecific from 1957 until very recently, despite some patent differences, especially in coloration, a feature in which they represent the two extremes of the genus. In the end, a detailed study by R. C. Banks has shown that these hybrids came from an area in which *Ortalis* does not appear to exist naturally. Thus, they may have been the offspring of escapes, and certainly chachalacas are frequently kept in captivity in this area.

Cracids do produce hybrids, often fertile ones, quite easily in captivity, even between members of different genera. In contrast, however, there are remarkably few cases of hybridization in the wild between different cracids. One such case from north-west Colombia refers to one or two intermediates between the Grey-headed Chachalaca (*Ortalis cinereiceps*) and the Chestnut-winged Chachalaca (*Ortalis garrula*). This case was one of the deciding factors, along with the coincidence of chestnut primaries, in these two forms being considered conspecific, despite notable differences in plumage, size and voice; in this last aspect, they differ more than any two other species in the genus. The validity of these supposed hybrids has also been questioned, above all by J. Hafner, who studied the area thoroughly and showed that there was an appreciable gap between the distributions of the two forms, in the densely forested region between the Sinu River and the Gulf of Uraba, which

is probably unsuitable for any chachalaca. As a result, the apparently intermediate individuals were attributed to cases of occasional introgression, or even to strays of one form or the other. In any case, even if they are valid hybrids, they do not demonstrate more than sporadic, limited hybridization that does not necessarily negate the validity of the two forms as different species. Interestingly, although regrettably, the issue of whether or not they are valid species will almost certainly be solved in the near future, since the gap between their ranges is shrinking rapidly due to continuous deforestation in the Uraba region, so both forms will probably come into extensive contact, if they have not already done so.

Some definite cases of intergradation between different subspecies of the same species are well known. Such is the case of the nominate race and the race *ruficauda* of the Rufous-vented Chachalaca (*Ortalis ruficauda*), which are well differentiated by having the tips of their tails respectively rich chestnut and greyish white. In areas of contact between the two populations, intermediate birds are found with buffy tail tips, and in the area around Lake Maracaibo, in Venezuela, such birds have even sometimes been considered a different subspecies, *baliolus*. The existence of such intermediate birds suggests that it is better to consider these forms conspecific, at any rate for the time being, although future field studies may demonstrate that they are really two species which hybridize only to a limited extent.

Finally, there is also intergradation in the Speckled Chachalaca (*Ortalis guttata*) between the nominate race and the race *subaffinis*, in the lowlands of north-east Bolivia and adjacent Brazil, and this is probably one of the main reasons why this is one of the eight or nine forms in the taxonomically complicated *Ortalis motmot* superspecies for which nobody proposes full species status. All these forms are distinguished from the other species of the genus by having somewhat narrow, stiffened neck and breast feathers and generally less fluffy plumage, and the fact that the White-bellied Chachalaca shows the same features has led to its inclusion in this complex, whereas in the past it was often considered a subspecies of the Plain Chachalaca. The most widely accepted version, followed here, groups all the forms in this complex into four species: the monotypic White-bellied Chachalaca; the Speckled Chachalaca, with five subspecies; the Little Chachalaca (*Ortalis motmot*), with two; and the monotypic Buff-browed Chachalaca (*Ortalis supercilialis*). However, four races of the Speckled Chachalaca, *columbiana*, *araucuan*, *squamata* and *guttata*, are quite dissimilar and are geographically isolated. Delacour and Amadon, when reviewing this genus in their authoritative

The taxonomic status of the two members of the genus *Chamaepetes*, the Sickie-winged Guan (seen here) and the Black Guan (*Chamaepetes unicolor*), is amongst the least disputed in the family. Within the subfamily Penelopinae, comprising the chachalacas and the guans, they are the only species that show a fully, densely feathered throat, and as a result lack wattles or caruncles of any kind.

[*Chamaepetes goudotii*. Photo: Josep del Hoyo/Lynx]



The Nocturnal Curassow is the only member of the subfamily Cracinae, the curassows, that has its own monotypic genus. Although its habits now seem to be much less nocturnal than was hitherto thought, some characteristics, such as the cryptic plumage of both sexes or the brightly coloured face, are unique within this group. This species is also considerably smaller than all the other curassows.

[*Nothocrax urumutum*. Photo: Josep del Hoyo/Lynx]

The Highland Guan, another species placed in a monotypic genus, is one of the most unusual members of the family. It is the only guan with marked sexual dimorphism, the female having cryptic brown plumage. It is also the only species in which the male has bare gular skin hanging down to form a conspicuous dewlap, while such an appendage is completely lacking in the female. Finally, it is the only cracid in which the female is slightly larger than the male.

[*Penelopina nigra*,
Chiapas, Mexico.

Photo: Patricio Robles Gil]



monograph of the Cracidae, believed that either the four aforementioned forms were, in fact, four different species, or else three other forms, *motmot*, *ruficeps* and *superciliaris* were also conspecific with *guttata*. In order to avoid erecting "new" species they adopted the latter alternative, creating an expanded *Ortalis motmot* that they called the Variable Chachalaca, in order to emphasize the remarkable diversity of the forms included.

Penelope, with fifteen species, contains more species than any other cracid genus. Like *Ortalis*, it is a fairly homogeneous, not very specialized group, that similarly raises numerous taxonomic issues. There is relative agreement that the members of the genus fall into three species groups: one group of small species and two groups of large species. The group of small species is formed by the Band-tailed Guan (*Penelope argyrotis*), the Bearded Guan (*Penelope barbata*), the Baudo Guan (*Penelope ortonii*), the Andean Guan (*Penelope montagnii*), the Marail Guan (*Penelope marail*) and the Rusty-margined Guan (*Penelope superciliaris*); the first of the two groups of large species comprises the Red-faced Guan (*Penelope dabbenetii*), the Crested Guan (*Penelope purpurascens*), the Cauca Guan (*Penelope perspicax*), the White-winged Guan (*Penelope albigularis*), Spix's Guan (*Penelope jacquacu*) and the Dusky-legged Guan (*Penelope obscura*); and the second, the White-crested Guan (*Penelope pileata*), the Chestnut-bellied Guan (*Penelope ochrogaster*) and the White-browed Guan (*Penelope jacucaca*).

The three forms in the last group were formerly considered to be races of the same species, but apart from this there is no controversy concerning their status. In the other two groups, on the other hand, there are numerous cases which have in the past provoked a great deal of speculation, and today there is still a certain amount of disagreement.

The issue of whether the Bearded Guan is a valid species or should be included in the Band-tailed Guan, as a race, is one of the most disputed. The two are obviously close relatives, as indicated by their very similar general appearance, and the fact that they are the only two members of the genus with a rufous terminal band on the tail, but other important features differentiate them. As its name suggests, the Bearded Guan has the

front part of the throat feathered, as well as the upper part of the tarsus, which indicates that although both are mountain species, this one is adapted to a colder habitat (see Morphological Aspects). Another significant difference is connected with the outer primaries modified for the production of mechanical sounds in all guans (see Morphological Aspects); while the Bearded Guan shows only a slight modification, the Band-tailed Guan is one of the most specialized species of *Penelope* in this aspect. Because of this, and also their widely disjunct range, it is now more usual to consider these two forms as specifically distinct.

There is certain controversy about the affinities of the Baudo Guan. Although it is a small species, it has been associated with the *Penelope obscura* superspecies, sometimes known as the *Penelope purpurascens-jacquacu* complex, and even considered conspecific with one of its members, the White-winged Guan. It was alternatively included in the Andean Guan, as a race, based on slight similarities with two of the Andean Guan's races. C. Vaurie, in his revision of the family based on a careful study of a large number of specimens, offered convincing reasons for rejecting both proposals. More recently, in a study of the systematic relationships of the White-winged Guan and related forms, J. W. Eley concluded that the Baudo Guan's nearest relative was the Marail Guan. He suggests that an ancestral form of both would have had a wide distribution over much of tropical South America during the Pleistocene, and that climatic fluctuations led to the formation of these two species and also of the Rusty-margined Guan.

The validity of the Cauca Guan as a species has never been unanimously recognized, but those who do not accept it further differ as to the species of which it should be considered a subspecies, and it has been included either in Spix's or the Crested Guan. The fact is that the Cauca Guan is morphometrically closer to the former, with which it shares some plumage features, while in other plumage features it is more similar to the latter, with which it also shares the lack of a tracheal loop. Taking everything into account, Eley suggests that the species could have arisen from an isolated population of the ancestral form of Spix's and the Crested Guans before their differentiation, which would reinforce its taxonomical validity as species.



However, the systematic debate has not been as marked in any other member of the genus as in the case of the White-winged Guan. The fact that it was believed to be extinct for a century until its rediscovery in 1977 (see Status and Conservation), and that during all that time only three old specimens existed, has certainly been the main reason for the uncertainty. The species was alternately associated with Spix's, the Crested and the Baudo Guans, and even its validity as an independent taxon was questioned, as it was suggested that it had been described from a partially albinistic specimen of either the Crested or the Baudo Guan, or that it constituted a morph or variant of one of them. The existence of several abnormal specimens of the Baudo Guan with white patches scattered throughout the plumage, and the confirmation that the Crested Guan in captivity occasionally produces individuals with white primaries, and sometimes in the wild too, seemed to lend support to this line of thinking.

However, the rediscovery of the form allowed the examination of many more individuals, and also the collection of information on the natural history of the species, for instance on its vocalizations, and Eley's study using such information has shown it to be a valid species. It is one of the most distinctive forms in the genus, with at least two unique characteristics: the eight outermost primaries are white; and the bill is bicoloured. The voice is quite similar to that of the Crested Guan, far more so than to that of Spix's Guan, which is why, in contrast to the case of the Cauca Guan, Eley suggests that the species could have appeared after the isolation in west Peru of an ancestral form of the Crested Guan that was already differentiated from the ancestral form of Spix's Guan.

The six forms included in the genus *Pipile* have been the subject of so much controversy in terms of their relationships with each other and with other guans that virtually all possible permutations must have been proposed at one time or another. They have been merged into a single species, or at the other extreme considered six different species, as well as all the intermediate possibilities between these two. They have been included in the genus *Penelope*, when it was thought that they only constituted a distinctive species group within it. Another

author, however, suggests that they should be separated from Penelopinae into a separate tribe, Pipilinae, into which their relatives of the genera *Aburria* and *Chamaepetes* would also be incorporated. Delacour and Amadon disbanded the genus *Pipile*, merging it into *Aburria*, perhaps inappropriately, as the members of *Pipile*, widely distributed in South America, constitute a notably homogeneous unit and are clearly different from the Wattled Guan (*Aburria aburri*), which constitutes a monotypic genus restricted to the Andes.

The present version recognizes four species, the Trinidad (*Pipile pipile*), Blue-throated (*Pipile cumanensis*), Red-throated (*Pipile cunjubi*) and Black-fronted (*Pipile jacutinga*) Piping-guans. The form *grayi* is maintained as a race of the Blue-throated Piping-guan as it appears to intergrade with the nominate race in south-east Peru, while the form *nattereri* is included in the Red-throated Piping-guan as these two are morphologically very similar. New field work might, of course, provide evidence that these two forms should be treated as different species, or equally that the first three species are really conspecific. The only point of fairly general agreement is that the distinctive Black-fronted Piping-guan merits treatment as a separate species. The case of *Pipile* is a good one for illustrating some of the difficulties regularly encountered in taxonomic work, and the inevitable subjectivity involved.

As for the rest of the species of the tribe, the Wattled, Black (*Chamaepetes unicolor*), Sickie-winged (*Chamaepetes goudotii*), Highland (*Penelopina nigra*) and Horned Guans provoke much less debate than the genera previously mentioned, although the relationships of the Highland Guan have also been controversial. Vuilleumier considered it intermediate between the chachalacas and the guans, and the species has commonly been called the Black Chachalaca. Nevertheless, Vaurie studied the species in detail and deduced that it is not related to *Ortalis*, but rather that it was a very peculiar member of the guans. Certainly the species presents several features unique among the cracids, such as the female being larger than the male, and indeed it is the only guan presenting marked sexual dimorphism (see Morphological Aspects). The fact that one of the two species of *Chamaepetes* is black and the other brown, the colours of the male and the female respectively of the Highland Guan, was interpreted by Delacour and Amadon as suggestive of a link between the two genera.

As for the Cracinae, the curassows, the main discrepancies concern the assignment to genera. All species have on occasions been lumped in *Crax*, although nowadays it seems that there is general agreement in awarding a separate genus to the Nocturnal Curassow (*Nothocrax urumutum*), which is smaller than the rest, with a brightly coloured face and completely different plumage. However, Delacour and Amadon also merged the genera *Mitu* and *Pauxi* into *Crax*, to emphasize the

The genus *Aburria*, to which the Wattled Guan belongs, has traditionally been considered monotypic, although some authors have included the piping-guans (*Pipile*). However, the piping-guans form a homogeneous group that is widely distributed throughout much of South America, whilst the Wattled Guan is restricted to the Andes and, as can be seen here, presents certain marked peculiarities, including a completely feathered face and the distinctive worm-like caruncle hanging from the throat.

[*Aburria aburri*.
Photo: Josep del Hoyo/
Lynx]



Hybridization between different cracid species is very rare in the wild but relatively common in captivity, even between members of different genera. This photograph shows a cross between a West Mexican Chachalaca and a Crestless Curassow, produced in the aviaries of J. Estudillo in Mexico.

[*Ortalis poliocephala* x
Mitu tomentosa.
Photo: Josep del Hoyo/
Lynx]

close relationships. However, as pointed out by K. H. Voous, the genus, unlike the species, is an abstraction, and as such does not exist in nature, so pragmatic rather than scientific values should be used in order to decide generic limits. It does not seem appropriate to mix the true *Crax* or "bushy crested" curassows, all of them members of a superspecies, with other more obviously different forms. The species usually included in *Mitu* are anyway closer to *Nothocrax* than to true *Crax*. Besides, the norm in Cracidae is generally that species in the same genus are allopatric, and replace one another. This norm is maintained if the classic genera are maintained, but not if they are amalgamated, since various species, especially in *Mitu* and *Crax*, are broadly sympatric, with two species able to co-exist in the same forest.

The separation of the various forms into different species is much clearer than in *Ortalis*, *Penelope* or *Pipile*. It is interesting to note that the Alagoas Curassow (*Mitu mitu*), which is now practically extinct (see Status and Conservation), was long considered conspecific with the Razor-billed Curassow (*Mitu tuberosa*). As with the White-winged Guan, the lack of data and material prevented any detailed study. This case was even more enigmatic, as the specimen with which the species had originally been described was not preserved, and no other was obtained until the rediscovery of the form in 1951. Subsequently, a captive population was established, in which diverse aspects have been studied, including voice and karyotype, and this has shown that, although the two forms are very closely related, they have disjunct ranges and there are enough differences to merit their separation as two different species. For example, the Alagoas Curassow is unique in having a bare patch around the ear, and in having fourteen rectrices in both sexes, which are tipped pale brown, as opposed to white.

The forms included in the genus *Pauxi* have also been subject to diverse treatment as species or subspecies. When the Southern Helmeted Curassow (*Pauxi unicornis*) was described in 1939, it was considered a separate species from its better known northern counterpart, the Northern Helmeted Curassow (*Pauxi pauxi*), based mainly on the notably different shape of its helmet, which is cylindrical, not swollen, and its glossy,

curled crest. However, the subsequent discovery of a new race, *gilliardi*, of the northern species with a far less swollen helmet, prompted different authors to consider the three forms as subspecies of the same species. Later, with the discovery in Peru of a new race, *koepckae*, of the Southern Helmeted Curassow, geographically almost half way between the other two, but morphologically not approaching the northern form, the idea that they are actually two different species has been reinforced.

Over the years, several species have been described that have later been shown to be based on errors, and curiously they have always been forms in the genus *Crax*. Thus, "*Crax chapmani*" and "*Crax hecki*" were described from females of the rare barred morph of the Great Curassow (*Crax rubra*), while a female of the rare black and white morph and an immature male of the Blue-billed Curassow (*Crax alberti*) gave rise to "*Crax annulata*". The type of "*Crax incommoda*" turned out to be a rather unusual female of the Yellow-knobbed Curassow (*Crax daubentoni*), while that of "*Crax rubrirostris*" was a male of the Red-billed Curassow (*Crax blumenbachii*), since for a time it was thought that the male and female of this species were really two different species.

With all these precedents, it seems hardly surprising that the validity of a new species described in 1977 was either doubted or rejected by most authors who discussed it; this was the so-called Green-billed Curassow ("*Crax estudilloi*"), described from a single aviary bird obtained as a captive chick in La Paz Department, Bolivia. Its unique character, the pale green base of the bill, has tentatively been attributed to an inappropriate diet, to developmental abnormalities or often to hybridization between the Bare-faced Curassow (*Crax fasciolata*) and some other species of *Crax*. Another curassow with a pale green bill, described by Sclater in 1875 as "*Crax viridirostris*", and perfectly illustrated in one of his publications, was also based on a captive bird, found in Amsterdam Zoo, and so it could have been the result of the same causes. It is interesting to note that hybrids of the Blue-billed Curassow with both the Great and Bare-faced Curassows has a green cere, but it seems rather unlikely that individuals of this Colombian endemic could be found captive in Bolivia. Also, it seems that some features noted in the captive bird were quite distinctive, espe-

The Plain Chachalaca owes its common name to its colouring, not to the type of habitat it occupies! In fact, the genus *Ortalis*, to which all the chachalacas belong, is noteworthy for plain coloration and small size, as well as a lack of wattles, caruncles or any other type of embellishment on the head, although there is bare skin on the throat. These characteristics have led to the chachalacas' being considered the most primitive members of the family, for which reason they are placed at the beginning of the taxonomic sequence.

[*Ortalis vetula mcallii*,
Texas, USA.
Photo: J. Davies/Aquila]





The most typical guans are the fifteen species of *Penelope*, the most diversified genus in the whole family. They have more striking plumage than the chachalacas and are larger, although they share the same slender body. In addition, in all species both sexes have a prominent bright red dewlap formed by the bare skin of the throat, as can be seen in this Rusty-margined Guan. This bird also shows the trait to which the species owes its common name, and which differentiates it from all the other guans, namely the rusty buff to chestnut fringes on the inner secondaries, scapulars and upperwing-coverts.

[*Penelope supercilialis*, Brazil.
Photo: R. Seitre/Bios]

cially the voice. Ultimately, all this lengthy theorizing calls for a field expedition to investigate the validity of this hypothetical new species.

Morphological Aspects

Cracids range from medium-sized, in the case of the chachalacas, to large, in the case of the curassows and some guans, with most guans occupying an intermediate position. The smallest species, the Buff-browed Chachalaca, has a total length of about 42 cm, while some Great Curassows in the northern part of the species' range reach 92 cm.

The general appearance of cracids is similar to that of other gallinaceous birds, and varies relatively little over the family as a whole. The body is heavy in all species, especially the curassows, while the chachalacas and the guans have a more slender build, which enables them to move more freely about in thick vegetation, as these species are more arboreal than the curassows. For example, while a male of the Great Curassow could easily weigh more than 4 kg, the Crested Guan, the largest *Penelope*, does not usually reach 2.5 kg, although it is only a little smaller lengthwise. This difference in body structure is related to the different pelvic proportions of the two, one of the features on which the division into two subfamilies is based (see Systematics).

The neck is long and the head small, often with a crest, which can be longer and more curved depending on the species; this is raised conspicuously when the bird is excited, and is apparently important in displays. In general, the bill is similar to a domestic chicken's and is normally medium-sized, though somewhat heavier in the curassows. However, in the four species of the genus *Mitu*, it is considerably modified, not in relation to any specialized diet, but rather as an element in display. In this genus the massive bill carries out the same function as the dewlaps, wattles, helmets and other ornaments that many other species have.

The legs are long and strong, longest in the curassows, again as an adaptation to their more terrestrial habits, and shortest in the guans, the most arboreal members of the family.

Unlike all other Galliformes, except the megapodes, cracids have an elongated hind toe on the same level as the three front toes, which is a perfect adaptation for perching in trees, and even the most terrestrial species often do so. Consequently, they are capable of moving adeptly among the branches, hopping from limb to limb, and can grasp even very thin branches. The chachalacas are even able to move through thick vegetation at great speed and with remarkable agility, using their wings to help, in a movement that appears to be half way between running and flying.

The legs are equally good for walking, and even the most arboreal species sometimes descend to the ground, at least in order to feed on fallen fruits or to drink. They walk elegantly with long steps, and can trot gracefully and even run, although not as fast as the more terrestrial Galliformes.

All species have a long tail and strongly rounded, concave wings. Their pectoral musculature is well developed, but their capacity for flight is moderate, and sustained flights are rare, but after a flurry of wingbeats they make long glides in which the long tail provides extra support. When they move long distances they normally glide, especially the guans. A bird loses height gradually and when it comes to a halt at the base of a tree, it climbs up again through the branches until it reaches the canopy from where it will throw itself off into a new glide. When startled, unlike many pheasants which tend to hide on the ground, most cracids fly away, even the larger species, although the curassows sometimes run away. Their flying ability is more than sufficient for making a quick escape, although when flushed the speed of their wingbeats is notably less than that of partridges, pheasants and other terrestrial Galliformes. Logically, the curassows are the poorest fliers, while the guans, especially the piping-guans (*Pipile*), are the best.

The consistency of the plumage is variable. It is generally soft, particularly in the chachalacas that live in warmer, drier areas than the other species, but it can be much more dense and compact, repelling water readily, in the species that live in cold rainy areas, such as cloud forests.

Coloration, although often attractive, is usually discreet, and in this sense camouflage has greater influence than display. The Nocturnal Curassow is an extreme case, as both sexes have

The Blue-throated Piping-guan and its congeners are the best fliers amongst the Cracidae. Notwithstanding, their normal method for travelling fair distances, in common with the other guans, is by means of lengthy glides on their broad, concave wings, while the long tail serves to provide extra support in the air. Once a gliding bird has lost height, it lands low in a tree, climbs up into the canopy and then sets off on a new glide.

[*Pipile cumanensis grayi*,
Pantanal,
Mato Grosso, Brazil.
Photo: Günter Ziesler/
Bruce Coleman]



barred, mottled, very cryptic plumage. The chachalacas have the dullest plumage, which is related to their less thickly wooded habitats. But even in these rather plain species there are some parts of the plumage that serve to make them more conspicuous, for example to keep the groups within visual contact, or for use in breeding displays. This is the function of the white or chestnut tail tips and the rich rufous primaries or head found in many chachalacas, and also of the white patches on the shoulders of the piping-guans.

In this family there are also plumages that have a definite display function. In most cases they are black with a greenish or bluish sheen above, often contrasting conspicuously with snowy white underparts. Delacour and Amadon came to the conclusion that cryptic plumage is ancestral in this family, while black or black and white represent a more advanced type selected for display. This evolutionary tendency nor-

mally takes place first in the male, but later in the female too, which is hardly surprising, given that some sexual displays in cracids are probably mutual (see Breeding), as is often the case in monogamous birds. According to this theory, species like the Highland Guan and the Great and Bare-faced Curassows, with the females notably more cryptic than the males, would have reached the first stage. Other species, notably the Wattled Curassow (*Crax globulosa*), in which the female is almost like the male but with the belly rufous instead of the more conspicuous white, would be gradually reaching the second stage. The Black Curassow (*Crax leucitor*) and the Northern Helmeted Curassow, amongst others, would have arrived fully at this stage, with the females practically identical to the males. In addition, the occurrence in the latter species of a brown barred morph that turns up sporadically in a few females can be considered a possible throwback to the original plumage of the female, and perhaps that of the male too.

Even in the species that have developed their plumage for display, the protective function is not lost. Obviously, the pure white feathers on the abdomen of several curassows are conspicuous, but they are only exhibited openly during courtship. The plumage is never brilliantly coloured, as is often the case with the facial skin, dewlaps, wattles and other appendages. These doubtless play a more important role than the plumage in displays performed at close quarters, but from a distance they are less conspicuous amidst the incredible diversity of forms and colours, especially of leaves, that dominate the interior of tropical forests.

While there are varying degrees of sexual dimorphism in the plumage of some curassows, in all chachalacas and all guans sexes are alike, with the remarkable exception of the Highland Guan, which shows considerable differences in the plumage and the dewlap. It is also the only species in the family in which females are larger than males. In all other species males average 5% larger than females, or rarely up to 10% larger. In some species iris colour differs with sex, for instance in the Dusky-legged Guan the iris is red in males but pale brown in females, but in other species, like the Rusty-margined Guan, both sexes have a red iris. Finally, the dewlap of the guans and piping-guans is, at least in some species such as the

The rare barred brown morph of the female Northern Helmeted Curassow. Note that this species does not normally show sexual dimorphism, with both sexes predominantly glossy black. This morph, with its cryptic plumage, has been interpreted as a possible throwback to a more ancestral, less evolved, plumage of the female.

[*Pauxi pauxi pauxi*.
Photo: Josep del Hoyo/
Lynx]





The curassows are generally larger than the guans, with a noticeably more robust body, in line with their much more terrestrial habits. The Great Curassow is the largest member of the genus *Crax* and has the most developed crest. It also shows the greatest sexual dimorphism in the curassows: the male is always glossy black, with a snowy white lower abdomen; the female, in contrast, is polymorphic, with a dark, a red, and a barred morph, all of which share, however, the characteristic black and white cross-barring on the head and neck, which distinguishes them from any other member of the family. Furthermore, females of the dark morph, the commonest in the northern part of the species' range, show a very wide range of individual variation, with scarcely two birds alike. The tail may be uniformly black or dark chestnut, or vermiculated with white, whilst the upperparts may be uniform or mottled with buffy white or blackish brown. In any form, they can be distinguished from red morph females by having the mantle, lower throat and upper breast blackish, and by the fact that the tail never has the boldly barred pattern which characterizes the red morph. Nevertheless, the different morphs appear to blend more or less into one another through a series of intermediate individuals.

[Above: *Crax rubra rubra*.
Photo: François Gohier/
Ardea



Below: *Crax rubra rubra*,
Costa Rica.
Photo: David Tipling/
Planet Earth]



Black-fronted Piping-guan, somewhat larger and more brightly coloured in males than in females.

Juvenile plumage is generally very similar to that of adults, if somewhat duller and a little softer; it is assumed at a very early age, even when the young bird is still noticeably smaller than the adults. Observations of very small birds in apparently adult plumage even caused some early workers to consider some juveniles as new species. Again, the exception to the norm is the Highland Guan, as the male does not acquire the black adult plumage until its second year, up to which time it is similar to the female.

Some published records of brown juvenile plumages in other cracid species are apparently erroneous, prompted by the occasional appearance, unrelated to age, of brown feathers in the black plumage of some curassows. There are many other plumage aberrations, like the occurrence of white tail tips, or their absence in species that normally have them without this being the result of abrasion, or a yellowish instead of white abdomen, or partial albinism. In fact, all of these are quite usual in the cracids, as recently shown by D. M. Teixeira and H. Sick, who suggest that in some cases, rather than aberrations, some might more appropriately be considered cases of polymorphism. Some morphs are already known amongst female curassows: for instance the aforementioned brown barred morph in the Northern Helmeted Curassow; a rare black and white barred morph in the Blue-billed Curassow; and the dark and red morphs, and also a rare barred morph, all in the Great Curassow, and varying regionally in their occurrence. Some females of the Wattled

Curassow also present a marbled pattern on the wings very similar to that which normally characterizes the female of the Red-billed Curassow.

Little is known about moult, but it is probably normally rather slow, affecting only one or two feathers at a time, in both the wings and the tail. Consequently, a curassow's wing can show feathers of three different moult cycles at the same time. This strategy may be possible because the birds live in tropical areas, where food is plentiful all year round.

An interesting adaptation in all guans, except the Horned Guan, is the modification of the distal 5-8 cm of the quills on the three or four outermost primaries, which permits the birds to produce a strange, very loud noise during their characteristic wing-drumming or wing-whirring displays (see Breeding). The modification can consist of: bowing, with the narrow tip of the outermost primary being strongly incurved, as in the Crested Guan, one of the species with a fairly subtle modification; stronger bowing and stiffening, as in other species of *Penelope*; or even, in addition to the strong curvature, an abrupt narrowing of the tips, as in the genera *Chamaepetes*, with the three outer primaries emarginated, and *Pipile* and *Aburria*, with the four outer primaries emarginated. It is worth noting that the degree of modification is not related to the frequency of these displays. For example, the slightly modified Crested Guan is a vigorous drummer, while the very specialized Wattled Guan is notably less so, but in the display of the latter the quality and pitch of the sound produced are much more striking.

Another characteristic morphological adaptation related to sound production is the modification of the trachea in many species. This is responsible for increasing the volume and lowering the pitch of calls. The modification consists of a variable lengthening of the trachea and the formation of a loop between the skin and the pectoral muscles, sometimes even extending to the belly before returning to the thoracic cavity. In some *Crax* curassows, the trachea is also flattened, so that it can be more than twice as wide one way as the other. All male chachalacas and curassows have modified tracheas, including the Wattled Curassow, which has a whistling as opposed to booming voice (see Voice), so this adaptation would not seem to make sense. In the guans this modification is found only in the genus *Penelope*, in which there is great variation: Spix's Guan has a very large loop; the Dusky-legged Guan a short one; and the Crested, Cauca, Andean and Baudo Guans do not have one at all. In *Penelope* the modification is present in both sexes, although the trachea is somewhat shorter in females. In other bird groups with similar modifications, such as the swans (*Cygnus*) and the cranes (*Grus*), the adaptation occurs only in the male.

Another distinctive feature of the cracids is the brightly coloured bare skin, in the cere, dewlaps and various kinds of appendage, such as wattles, knobs, horny helmets or integument-covered tubercles. In the *Mitu* curassows it is actually the bill that is modified for the same reason, and in some guans and curassows the legs too are bright red. The chachalacas generally lack such adornments, although the bare skin of the throat and sometimes the face, while not protruding, is also an eye-catching red or pink.

The function of these modifications is probably related to sexual recognition and the maintenance of the pair-bond, while they may also be used in courtship display. Their presence in both sexes in all chachalacas and guans, except the peculiar Highland Guan, and also in most curassows suggests that displays are mutual in these species, as is typical in other monogamous birds like grebes or cranes. Recent field research with several *Crax* curassows, in which the absence of any direct male to male combat has been proved, suggests that these adornments do not play a part in the expulsion of rivals of the same sex.

The variety of all these sexual characters in this family is remarkable, especially in the case of the curassows. Even within the same superspecies, in which the adornments start from the cere in all species, there are two with brightly coloured ceres but hardly any growth, one in which the growth on the upper mandible is enlarged but not that on the lower, one in which the

Birds of the red (above) and barred (below) morphs of the female Great Curassow. The relative abundance of each colour morph varies geographically, but this does not imply subspecific variation. The red morph is the only one known in the South American part of the species' range, but it is also found as far north, at least, as Honduras. The dark morph predominates in Mexico, but also occurs as far south as southern Costa Rica. The barred morph, the least common of the three, has only been recorded between the Isthmus of Tehuantepec and the Yucatán Peninsula, but always more sporadically than the dark morph.

[*Crax rubra rubra*.

Photos: Josep del Hoyo/Lynx]



opposite occurs, and three in which the knobs grow from both mandibles; all this varies through bright yellow and orange to red or blue. The enormous diversity of sexual adornments in this family is further proof that in the process of natural selection similar effects can be achieved by different paths.

But what are the evolutionary forces that influence the development of these extravagant adaptations? A recent study of the Yellow-knobbed Curassow by R. Buchholz shows a correlation between the age of males and the size of their knobs and wattles. It is supposed that in long-lived species like curassows, females prefer to mate with older males because these individuals have demonstrated their capacity for survival and they would transmit better genetic stock to their descendants. Thus, the size of these adornments might be used by females when choosing their mates, at least in some species, so they would be sexually selected.

Wattles, dewlaps and other areas of bare skin seem to be very small in some species of montane cloud forest, where night temperatures can be very low. Both the Andean and Bearded Guans have a partly feathered throat, and also the upper half of the tarsus. The Wattled and Horned Guans, also mountain species, likewise have much smaller areas of bare skin on the throat than do tropical guans. Once more, the Highland Guan is an exception, since the male has one of the largest dewlaps in the family, but the species inhabits mountains where night temperatures can be chilly.

Habitat

The cracids are essentially forest birds, which is hardly surprising as they are the only arboreal family in Galliformes. However, while the guans and curassows are found almost exclusively in forest, the chachalacas, although never present in arid areas or grasslands, are adapted for life in more open woodlands, and even in areas with few trees, as long as there is abundant bushy vegetation. In fact, they avoid the dense forest interior, although they can frequently be seen for example in clearings, in the undergrowth along streams or even in the

canopy. But guans and curassows are largely restricted to dense, humid forests, although some species occur, at least locally or seasonally, in more open forests, and others show preference for gallery forest. Also, from time to time, many guans venture into open areas near the forest, for example to visit a fruiting tree, especially in the dim light of morning or evening; this is much less frequent in curassows.

The types of forest inhabited by cracids are quite diverse. While chachalacas do not occur in unbroken humid forests, they are found in dry deciduous or semi-deciduous woodland, swamp and gallery forest and savanna, preferably in areas of contact with forest. They are also at home in secondary forest, plantations, especially of palms, brushland and thickets. Various species also occur locally in mangroves, and the race *deschauenseei* of the Plain Chachalaca, endemic to Utila Island, off northern Honduras, is actually now restricted to mangroves. Chachalacas are not particularly averse to cultivated or humanized areas, and are sometimes more abundant on the outskirts of small villages than in more remote areas.

Guans are restricted to the interior or margins of forests, mainly lowland rain forest, or, in mountain species, cloud forest. Often, the latter species prefer areas with an abundance of epiphytes, mosses and lianes. Some species are also present in tall second growth, especially where this is adjacent to primary forest, including swamp and gallery forest, and they can even turn up occasionally in coffee plantations. Several species of piping-guan are known to favour gallery forest, and the Black-fronted Piping-guan is normally associated with forests rich in palmito (*Euterpe edulis*), as its fruits form the bulk of the species' diet. In general, guans are not keen on drier forests, as is often apparent in the hills or mountains of Central America. In fact, in many areas where there is rain forest on the wet slope, and pine or pine and oak forest on the dry slope, guans and curassows are only present on the former. Locally, or seasonally, they can be found in drier habitats, as in the Crested Guan in west Mexico, which has been seen in oak-sweetgum and beech forest in Tamaulipas, and in humid pine-oak forest in Colima. The White-winged Guan is a special case with its present habitat of dry deciduous forest, although it seems to prefer the most humid parts, especially during the dry season. At the time of its discovery in 1876, this species also inhabited coastal fringe forest, and also islands in the delta of the Tumbes River with trees characteristic of dry forest, but densely fringed with mangroves. It seems that the species spent the hottest hours of the day in the dense mangroves, entering the dry forest at dawn and in the evening in order to feed.

The curassows are more strictly confined to rain forest than any other cracid group, and in many species there is a certain association with water, with a preference for flooded forests, borders of lakes and pools, or areas near rivers and streams. Some species also have a predilection for gallery forest, and it is in this habitat, in the *llanos* of Venezuela and Colombia, that the Yellow-knobbed Curassow is most common. The habitat of the only mountain curassows, the Southern and, especially, the Northern Helmeted Curassows, consists of cooler highland forests, with the latter preferring areas of very dense cloud forest. Curassows are even more reluctant than guans to enter dry forest. The Great Curassow, for example, is absent from the dry forests of west Mexico in which the Crested Guan occurs, and this appears to be the curassow least restricted to rain, cloud or gallery forest, as it is also found in seasonally drier forest in Yucatán and parts of Costa Rica, and even in scrubby woodland, in the case of the race *griscomi*, endemic to the island of Cozumel.

The altitudinal range occupied by the Cracidae is very wide. The widest diversity is in tropical lowlands, but several species live in mountains in subtropical and temperate zones. This is especially true of the guans, of which several species have morphological adaptations to help the birds tolerate these cold areas (see Morphological Aspects). The Andean Guan has been observed higher than any other cracid, at 3900 m in Peru, very close to the tree-line, but the Bearded, Red-faced, Wattled, Black, Sickie-winged, Highland and Horned Guans are also found in montane forest, often above 2500 m. In contrast,

The brightly coloured dewlaps that are found in all of the typical guans are believed to have a function in the maintenance of the pair-bond, and to play a role in courtship displays. Another characteristic common to the members of Penelope is the crest, formed by elongated crown feathers, which may be erected when the bird is excited. This feature is particularly pronounced in the Crested Guan, as its vernacular name suggests.

[*Penelope purpurascens*.
Photo: Rod Williams/
Bruce Coleman]

The curassows are undoubtedly the most highly evolved members of the family. Whereas in the guans functions of sexual recognition are attributed to the dewlaps, in the curassows these functions are performed by a very varied range of colourful appendages which decorate the heads of males, or, in some species, of both sexes.

The members of *Crax* have brilliantly coloured wattles and knobs, which start from the cere at the base of the bill, and vary with the species from yellow to orange, red or blue; again depending on the species, these adornments can be present only or mainly on the upper mandible, on the lower mandible, on both, or even, in one species, not at all. The

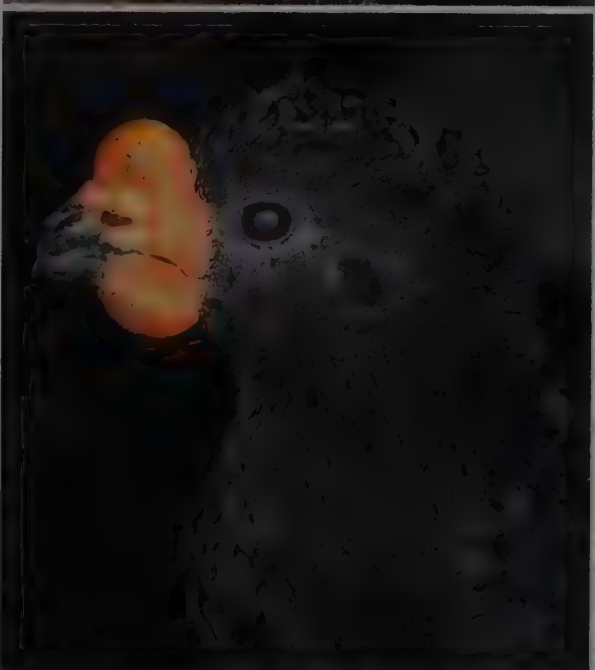
Yellow-knobbed, Blue-billed and Wattled Curassows give an idea of this rich variety. In the genus *Mitu*, the bright red bill itself has been modified, to a greater or lesser extent according to the species. The largest is the massive bill of the Razor-billed Curassow, which is entirely covered by the horny

ramphotheca. The two species of *Pauxi* have a large, raised, bony "helmet" on the forehead. The shape of the helmet, swollen and fig-shaped in the Northern Helmeted Curassow, more cylindrical and horn-shaped in the Southern Helmeted Curassow, is one of the main differences between the two species. Another is the crest formed of very short, tightly curled feathers, which, as is clearly visible here, is present in the southern species and lacking in the northern one.

[Left: *Crax daubentoni*,
Crax alberti,
Crax globulosa.

Right: *Mitu tuberosa*,
Pauxi pauxi pauxi,
Pauxi unicornis unicornis.

Photos: Josep del Hoyo/
Lynx]





The habitat of the West Mexican Chachalaca essentially consists of deciduous tropical forests, palm plantations and thick mangroves. The species does not occur in the most humid forest types, notably rain or cloud forest. In general, chachalacas are distinguished by their use of more open habitats, and they tend to avoid the interior of the dense, humid forests that form the principal habitat of the guans and curassows, although they may occur in forest edge and in clearings, or along streams and rivers.

[*Ortalis poliocephala*,
Chamela, Mexico.
Photo: X. Ferrer
& A. de Sostoa]

chachalacas and curassows are much more restricted to the lowlands, with the exception of the Northern Helmeted Curassow, which has been recorded at 2200 m. Nevertheless, some lowland species can be found at considerably higher altitudes in certain areas. The Great Curassow, generally a lowland bird, has been found at 1900 m in the Chiriqui Mountains of Panama. The same happens in some chachalacas, for instance the Speckled Chachalaca, which occurs at sea-level, but has also been observed at 2500 m in Colombia. Again, the West Mexican Chachalaca in the southern tip of its range manages to occupy fairly humid areas up to 3000 m. This last case refers to the area where the species overlaps with the Plain Chachalaca, a bird of drier habitats, and in this contact area the latter's preference seems to be even more accentuated. This appears to be a case of ecological segregation, which avoids or reduces competition between morphologically very similar species (see Systematics). A similar situation seems to arise in areas where two species of *Penelope* coincide. For instance, in south-east Venezuela, where Spix's and the Marail Guans coincide, the latter appears to be restricted to the forest interior, while the former is often seen at the forest edge, in clearings with scattered trees and in gallery forest. The remarkable size difference between these congeners probably helps to reduce competition, as it promotes the exploitation of different resources. Logically, such competition is much reduced or disappears between species of different genera, in which important adaptive differences have developed. In Vaupés, Colombia, the Nocturnal, Black and Crestless Curassows (*Mitu tomentosa*) and Spix's Guan can coincide in the same forest.

General Habits

The behaviour of cracids is generally not well known, because most species live in forests, often in the most inaccessible areas, and they inhabit the Neotropical Region, where very few detailed studies have been carried out. In addition, much of the information that has been regularly reiterated about the family comes from early South American explorers, many of whom based their accounts on rumours and legends of the local

people. Because they inhabit more open areas, frequently near settlements, and are thus much easier to observe, the chachalacas are generally the best known group.

Cracids tend to be fairly gregarious. Although it is not rare to find a lone bird, cracids are more often found in pairs or small family groups. Sometimes more numerous groups form, especially in chachalacas, which tend to be the most sociable group in the family, particularly outwith the breeding season. Thus, in several chachalaca species, groups of 20-30 birds may feed together; or even up to 50 Rufous-vented Chachalacas in the *llanos* of Venezuela. There is also an old record of a flock of more than 50 Crested Guans in the same fruit tree in Yucatán. Similarly, in various species of piping-guan, flocks of 10-20 are often sighted, in the past even of species that are now endangered, like the Trinidad and Black-fronted Piping-guans. Large flocks normally gather where food is abundant, typically in fruiting trees that also attract many other bird species. After feeding, the birds leave the tree and the group splits up again into smaller units, generally pairs or females accompanied by a few young, the most typical social units in this family. Similar congregations occur at water-holes or other drinking sites, during droughts. Loose aggregations of up to 50 or occasionally 100 or more Yellow-knobbed Curassows used to occur in the dry season in the *llanos* of Venezuela, and smaller concentrations can still be found.

Single-sex flocks have been seen outside the breeding season on several occasions, with up to eleven Bare-faced Curassow males together. The record of a group of four male Red-billed Curassows at the beginning of the breeding season could refer to birds that had failed to establish territories.

Cracids are mostly diurnal, but singing and displays often take place in the dark. The characteristic wing-drumming flight displays of the guans are performed very early in the morning, when it is still so dark in the forest that it is difficult to imagine how they can see their way from perch to perch. The same time, about an hour before sunrise, is equally the peak moment for singing in curassows, but unlike the guans' wing-drumming displays, these can also be heard during the day, and they often continue into the first hours of darkness after sunset, or can even be heard in the middle of the night when the moon is full.

The curassows are typical inhabitants of the humid Neotropical forests. Some species prefer permanently or seasonally flooded forests, while others seem more closely tied to terra firme or other forest types, and the two species of Pauxi live in cloud or montane forest. Gallery forest is also used by some species, such as the Bare-faced Curassow, particularly in the Pantanal, an immense flooded zone in south-west Brazil which is particularly rich in this habitat type. The Yellow-knobbed Curassow (*Crax daubentonii*), present in an area of rather similar characteristics, the llanos of Venezuela and Colombia, is commoner in gallery forests than in any other habitat.

[*Crax fasciolata fasciolata*,
Pantanal,
Mato Grosso, Brazil.
Photo: Eric Soder/NHPA]



Nocturnal feeding has also been recorded. The Trinidad Piping-guan typically feeds in the late evening, but it usually continues foraging until one or two hours after nightfall, after which time the sound of fruit falling to the ground ceases abruptly. The Southern Helmeted Curassow has been seen feeding on moonlit nights, and is especially active on the days that follow moonless nights.

The case of the Nocturnal Curassow is exceptional. Unlike the other species, it sings only in hours of complete darkness, even when there is no moon; it is never heard during the day, not even at dawn or dusk. Because of this and the explanations of early naturalists, who heeded native reports that the bird spent the day sleeping in a hole at the base of a tree or between rocks, for a long time the species was believed totally nocturnal. Vaurie found that the orbits were proportionally larger than in the other species, even though live birds do not appear to have particularly large eyes. Nevertheless, when the species was first kept in captivity, it was noted that although the birds did indeed sing at night, they spent this time on a high perch hardly moving at all; in contrast, they were active on the ground in their enclosure during the day, when they ate the food that was provided. It was also argued then that their vegetarian diet would make it difficult for them to find their food in the dark, unlike the owls, nightjars and other nocturnal birds that eat animal food. For this reason, they are now believed to be diurnal, or at least partially so, perhaps feeding around dawn and dusk. Their nocturnal activity may even be limited to the territorial singing of males. However, conditions in captivity are obviously not the same as those in the wild, and until adequate field studies are carried out, the possibility remains that they are partially nocturnal. Another possible indication of nocturnal habits is the fact that they can often be heard in areas where heavy hunting pressure has practically eliminated all other curassows.

Most cracids follow a fairly similar daily routine. The White-winged Guan, for example, begins its activities at about 5:45 hours, before dawn, when it performs the early morning flight displays found in almost all guans; although these displays are mainly related to breeding (see Breeding), in many species they also take place outside the breeding season, at least

sporadically. A little later, the birds go down to the bottom of the valley to drink and feed until 7:30 or 8:00 hours, or even on occasions until 10:00 hours. They spend the hottest hours of the day in a cool, shady place where they rest and continue feeding, with very little movement, until they become active again between roughly 16:30 and 18:45 hours. After this, they look for somewhere to roost, generally well hidden in a tree at medium height, and here they pass the night. Often the roosting site varies from one day to the next, at any rate in the Crested Guan, when it has been observed several days in succession. This species normally wanders about all over its territory from day to day, only occasionally staying in roughly the same place two days running. On the other hand, other species, especially chachalacas, have been seen flying every evening to the same large tree, apparently to roost, which suggests that they probably roost communally. There is also a record of three Grey-headed Chachalacas roosting in close physical contact on a wire, and in roosting groups of this same species two birds were seen billing, as parrots do, although only for a few moments.

Activities carried out during the hours of rest include dust-bathing, sunning and preening. The Plain Chachalaca has been seen dust-bathing on paths and in cornfields, while three adjacent dust-baths of the Rufous-vented Chachalaca were found in the only suitable site with soft, dusty soil in an area of the Venezuelan llanos. These activities are important for removing parasites, keeping the feathers in good condition and keeping the plumage well oiled, but in some cracids they have the additional function of strengthening the pair-bond during courtship. Thus, the male Horned Guan often calls its females to the dust-bath, a gap in the forest caused by a treefall, where the sun reaches the forest floor and dries the soil. After both birds have bathed, the male usually feeds the female with green leaves; apparently, the nest-site is later chosen nearby. Similarly, in the Yellow-knobbed Curassow, apparently a polygynous species, like the Horned Guan (see Breeding), males have been seen courting one or even two females simultaneously at the dust-bath.

Preening is an activity to which cracids dedicate a considerable amount of time. One of the very few studies of cracid



behaviour, that by F. González-García on the Horned Guan in Chiapas, Mexico, showed that this species devoted more time to plumage care and cleaning than to any other activity, including feeding. Preening was performed in a tree, with the bird sitting or standing, and generally devoting most time to the feathers of the back and wings. After a preening session, the bird sometimes exposed its plumage to the sun, possibly in order to remove ectoparasites or to dry itself. Similarly, the Plain Chachalaca has been seen sunning, with wings and tail spread, in sunny spots on roads, while similar behaviour has been recorded in the Black Curassow, in small clearings or on roads. The Red-billed Curassow has been seen coming out onto tracks after rain, in order to dry and preen.

There are also stereotyped false preening movements, with the head thrown back over the shoulders and wings, but without the bill touching the feathers; they are normal in cracids and may indicate anxiety. Other common habits include flicking the tail feathers open and then shut, and quick, sideways flicks of the head. The latter could be a defence mechanism against insects that host parasitic nematode worms which sometimes afflict cracids' eyes, although in the Great and Salvin's Curassows (*Mitu salvini*), they have also been observed in relation to courtship feeding.

Voice

Cracids are highly vocal birds with a remarkable repertoire of songs and calls, some of which are very loud, such as the cries of chachalacas or the crowing of Spix's Guan that can be heard from a kilometre or more, depending on local topography. In many species the trachea is elongated, sometimes considerably, a modification that increases the loudness, especially of the low-pitched notes that are typical of many of their vocalizations (see Morphological Aspects). Nevertheless, vocal characteristics vary markedly among the different natural groups.

The songs of all chachalacas are similar, with one exception. They are loud cries, often emitted as well co-ordinated rhythmic duets by the members of a pair, or by more birds,

creating a strident, reverberating chorus, in which not only can the voices of individuals be distinguished but also those of pairs singing in duet. Often, the calling of a pair or a flock stimulates other birds to join in, filling the forest with an almost continuous "chachalaca chorus" which can last more than two hours, generally early in the morning. Indeed, the name "chachalaca" comes from the sound that the birds produce, as do many other local names, like Guacharaca, Charata or Wakago. Despite their resemblance, the calls of the different species are not identical, and this may be an important isolating mechanism. In support of this, the differences are more marked between species with partially sympatric ranges, as in Chiapas, southern Mexico, where the ranges of the Plain, West Mexican and White-bellied Chachalacas meet.

The single exception is the Grey-headed Chachalaca, as it does not produce the loud chorus characteristic of the other species. It makes quite different notes from those of the others, and never engages in the strident group calls. It is, however, a noisy bird too, and it emits a variety of mainly loud, harsh cries, although these do not follow any set pattern or rhythm.

Apart from their songs, all chachalacas have other calls, including squawks, whistles or clucking; these are made from time to time or repeatedly in different circumstances. Birds often make such sounds while feeding, which probably helps the pair or the group to stay together. Again, they may be used when birds come across other conspecifics alien to the group, and this can be followed by a confrontation. They are also used as an alarm call in the face of predators or man.

Guans are also noisy birds that produce diverse vocalizations, described as grunts, growls, cackles, yelps and crows, and which have been associated with courtship, mating, pair-bond and flock integrity, territorial confrontation and alarm. The discordant crowing of Spix's Guan, which mainly consists of hoarse notes, has been referred to as one of the loudest and most far-reaching sounds of any bird. However, the most characteristic display sounds of the guans are not vocal, but mechanical, namely the wing-drumming displays (see Breeding) for which the wings show special modifications (see Morphological Aspects). These sounds are often accompanied by vocalizations, either just beforehand or simultaneously, which might indicate that both serve the same purpose, at any rate to some extent. However, evidence suggests that calls have more of a territorial function, while wing-drumming is more related to courtship. In addition, some guans produce very characteristic songs, such as the loud siren or ring of the male Wattled Guan, to which it owes its generic name, *Aburria*. Other examples include the piping, a series of five or six clear

Sunbathing is one of the activities recorded amongst cracids during periods of rest. Sometimes the birds will sunbathe in trees, like this Band-tailed Guan, which is stretching its wing wide open to soak up the sun, but at any rate chachalacas and curassows will also sunbathe on the ground, for example in a clearing or in the middle of a road. One of the most obvious functions of sunbathing is to dry the feathers when they are wet, but it is also believed to be useful for removing ectoparasites.

[*Penelope argyrotis argyrotis*, Venezuela. Photo: G. I. Bernard/NHPA]



A captive Salvin's Curassow preening. Care and cleaning of the plumage is one of the activities to which cracids devote most time. The feathers of the back and wings are apparently those which receive most attention.

[*Mitu salvini*. Photo: Josep del Hoyo/Lynx]

The daily routine of the Rufous-vented Chachalaca is similar to that of nearly all the other species of cracids. Most feeding takes place during the first and last hours of the day, while most of the rest of the day is spent resting and in comfort activities, such as preening, dust-bathing and sunning. The chestnut tail tips of these two birds show that they are members of the nominate race, which occurs on Tobago. This is the only species of cracid on the island, and has officially been named Tobago's National Bird.

[*Ortalis ruficauda*
ruficauda, Tobago.
 Photo: William S. Paton/
 Planet Earth]



whistles gradually ascending in pitch, that has given rise to the common name of the piping-guans, and the loud, clear, human-like whistles of the Highland Guan, uttered with the bill wide open. However, in *Penelope* and probably also *Chamaepetes* there are no real songs, except perhaps in the Band-tailed Guan, which sometimes makes calls similar to the piping of piping-guans. The absence of true song in many guans may result from its substitution by wing-drumming, although some of the most specialized drummers, like the piping-guans, both sing and drum.

The Horned Guan is unusual amongst guans in terms of voice. It makes a mooing song composed of three or four soft, deep notes that are repeated with marked regularity several times a minute. The sound is noticeably ventriloquial, giving a false impression of the bird's whereabouts, and is quite similar to the typical song of curassows. This is one of the reasons why the species is sometimes considered to be half way between the guans and the curassows (see Systematics). It also produces a sound unique amongst cracids, by clacking its mandibles together repeatedly for a few seconds, probably in alarm.

Curassows have a very different song from those of the chachalacas and guans, except to some extent the Horned Guan. In most species the sound is a low-pitched ventriloquial booming, which is difficult to locate, and which never sounds loud even in close proximity to the singing bird. The sound is like that made by blowing across the mouth of an empty bottle. Booming lasts 5-7 seconds and is emitted at intervals of roughly 12 seconds for about half an hour, normally in the early morning or the evening, but sometimes during nights with a full moon, and occasionally, for shorter periods, at any hour of the day. In captivity it has been seen that when the bird booms, the bill remains closed, implying that the sound may be, at least partly, non-vocal in origin; thus, the "oomh" might be the result of a powerful expulsion of air from the throat. In support of this, some males captured during the courtship period had the skin of the neck richly vascularized, perhaps to prevent it stretching when it is distended by the accumulated air.

Apparently only male curassows boom, but females can make low-pitched notes, for instance those emitted repeatedly by pairs in order to maintain contact while walking through the

forest. Differences in song pattern could also act as isolating mechanisms to help prevent hybridization when the ranges of two booming curassows overlap, as is probably the case among chachalacas.

Curiously, the Yellow-knobbed and Wattled Curassows, members of a superspecies that contains some of the most typical boomers, have a completely different song. Instead of booming, the males' song consists of a long, leisurely whistle. More emphatic whistles are also made by some of the other species, for instance the Great Curassow, not as songs, but rather as signs of irritation or alarm.

In general, cracids' songs are associated with the breeding season, although singing can go on to varying degrees throughout the year. At least in the majority of species, the song clearly has a territorial function, as much to attract a mate as to warn off rival males, and very probably also to reinforce the pair-bond, or the cohesion of a group in the more social species.

The chicks and half-grown young of several species, when wandering along in the company of adults, make soft piping sounds from time to time that enable them to be located rapidly, although this can betray their presence to predators. In such flocks, the adults also tend to repeat warning cries of low or medium intensity, in order to prevent the most vulnerable young from straying.

Food and Feeding

The cracids are essentially vegetarian. Although detailed studies on feeding have only been carried out on a few species, and the data available on the rest come from very limited field observations or the stomach content of collected specimens, it seems that they take animal prey only occasionally. In such cases, prey includes fair sized insects, like grasshoppers, beetles or caterpillars, or other invertebrates, like spiders, centipedes and some molluscs, although exceptionally vertebrates have been recorded, including salamanders, caecilians, tree frogs and small rodents. The Razor-billed Curassow has also been seen taking ants and termites in an opportunistic manner, after coming on their columns, while foraging for fruits and seeds as



These three Plain Chachalacas huddled together demonstrate a form of behaviour that is not unusual amongst the chachalacas, and, in fact, it often results in full bodily contact. This behaviour, together with some observations which indicate the possible existence of communal roosting sites, suggests that the chachalacas are the most sociable of the cracids.

[*Ortalis vetula*.
Photo: Leonard Lee Rue/
FLPA]

usual. Also, when curassows first offer food to their chicks, this often includes invertebrates, such as insect larvae and termites.

The plant matter that constitutes the bulk of the diet includes fruits of all types, seeds, flowers, buds, twigs, shoots and leaves. Leaves are usually eaten by the chachalacas and various species of guan in considerable quantities, and not only those that are sprouting or are still very tender, as typically consumed by several other groups of birds, but also much coarser ones, that are otherwise frequently eaten only by the Hoatzin (*Opisthocomus hoazin*). Leaves are sometimes swallowed whole, but often, at least in chachalacas, bits are plucked off a leaf that is still attached to a twig. Whole flowers may be taken or sometimes only the petals, depending on the plant species. Large fruits like mangoes and guavas are pecked at, while berries and other smaller fruits are swallowed whole one by one. Sometimes, after swallowing a fruit whole and taking the pulp into the crop or the gullet, a bird regurgitates the hard, indigestible seeds, as is the case of the Black-fronted Piping-guan with certain palm fruits. In other cases, fruit stones pass through the digestive tract whole and are then defecated.

In contrast, curassows have a powerful, muscular gizzard with a rough lining, which can easily crush nuts and hard seeds of up to 2 cm in diameter, and such food forms an important part of their diet. Some fairly large guans also have quite muscular gizzards, which have thinner walls than those of curassows, but which are capable of grinding down acorns, a typical food in the diet of the Crested Guan; they can also deal with the hard or unripe fruits, including palm fruit, that are often consumed by the piping-guans. The smaller species of guans, though, have to feed on softer fruits, shoots and green leaves. In an area in the south of Mexico where the Great Curassow, the Crested Guan and the Plain Chachalaca coincide, the berries of the hackberry (*Celtis laevigata*) form part of the diet of the three species, but the last two digest only the pulp that encloses the seeds, while the curassow, with its more powerful gizzard, is capable of crushing and therefore assimilating the seeds too.

This disparity in the ability to digest seeds implies different relationships between these birds, which are basically or partially frugivorous, and the plants on which they feed. The

species that regurgitate or defecate the seeds whole play an important role in the dispersion of some plants, but it has been suggested that the species that destroy the seeds with their gizzards also exercise a positive effect on the plant. This process favours the scattered seedlings that do indeed sprout, by reducing competition between them and perhaps also preventing the propagation of parasites.

In general, each cracid species consumes a remarkable diversity of plant species, with one or other predominating, or varying in comparative importance throughout the year, depending on when each sprouts or flowers, or when the fruit ripens. Recent studies of several cracids have identified a fair number of food plants, for instance 43 for the White-winged Guan in northern Peru, 68 for the Razor-billed Curassow in Peru, and 80 for the Black Curassow in French Guiana. It has recently been suggested that the diversity of the diet, in terms of both the species and the parts of the plants consumed, is modified with the season. The diet is more varied during the dry season or during the transition from the dry to the wet season, because food is scarcer, and above all because fruit production is minimal. In the rainy season, the time of maximum abundance, the bird's ecological niche is narrower, not only with fewer species consumed but also with food being selected more carefully.

Recently, M. Théry, C. Énard and D. Sabatier, who had already studied the diet of the Black Curassow and other frugivorous birds in French Guiana, investigated the feeding habits of the Marail Guan, which were completely unknown until then. They found that this species was highly selective. The fruits of only four plant species constituted 75% of the diet, with only 24 plants identified in all, half of which contributed less than 1% in total. The species is almost completely frugivorous, depending almost entirely on fruit even in the dry season, when other species increase the proportion of flowers and other plant elements in their diets. This tendency might be related to security against potential predators, which are numerous for this species because of its small size. Birds feed at a few particular sites, where their main food species abound, moving quickly and directly between these areas and resting places, without feeding on the way. The Black Curassow, in contrast, with a smaller range of potential predators due to its

larger size, feeds on fallen fruit, as it moves along more slowly over less fixed routes.

In some cracids, a certain type of food can dominate quantitatively, at least in part of the range, although this phenomenon is not common. It is the case of the Black-fronted Piping-guan, which is particularly keen on the fruit of the palmito, in search of which it will move long distances (see Movements).

Occasionally, chachalacas and some guans visit cultivation in order to feed. They sometimes eat shoots of maize, beans and sweet potatoes, and also coffee beans. In the case of the Dusky-legged Guan, birds have been known to invade poultry yards to feed on corn. However, such occurrences are sufficiently infrequent that they are not usually considered a nuisance to man.

All cracids can store food before beginning to digest it, and, although only the curassows have a true crop, the oesophagus of the guans and chachalacas is greatly expandable and serves the same purpose. First the stomach is emptied and then the next batch of food enters from the crop or the gullet.

The various food items are taken with the bill from trees and shrubs, at any height, or from the ground, where fallen fruit, various kinds of seed and sometimes insects or other invertebrates can also be found. The curassows generally feed on the ground, while guans are predominantly arboreal, although sometimes they too feed on the ground, especially taking fallen fruit after visits by groups of monkeys, parrots, toucans or other birds. The chachalacas are more terrestrial in their feeding than most guans, but they often take their food directly off the vegetation. On the ground, cracids occasionally scratch with their feet to uncover food, but much less frequently than in other gallinaceous birds, such as junglefowl (*Gallus*) and their domestic descendants.

Many cracids, especially the curassows, often swallow small pebbles, which help them to grind up hard food in the gizzard. Several species visit salt-licks to take in salty earth; they also visit certain areas in order to ingest clay-like soil, which probably responds to the necessity of adding mineral supplements to their diets.

Cracids drink, especially during the dry season. They come down to the ground to drink from streams, rivers or ponds, sucking with the bill held under the water. They have also been seen taking water trapped in leaf bracts or in the flowers of forest epiphytes, or drinking from leaf tips as the drops fall after heavy rain.

Chachalacas and guans feed their chicks by regurgitating food which they then drop from the bill. With the bill tip, curassows sometimes offer food to their chicks, when these are very small, but unlike the other members of the family, they never regurgitate it. Cracid chicks show a great capacity for finding food from a very early age, although the adults often call them to indicate a particularly good food source. Even when they are fully-grown and capable of foraging by themselves, young birds still sometimes receive food from their parents.

Breeding

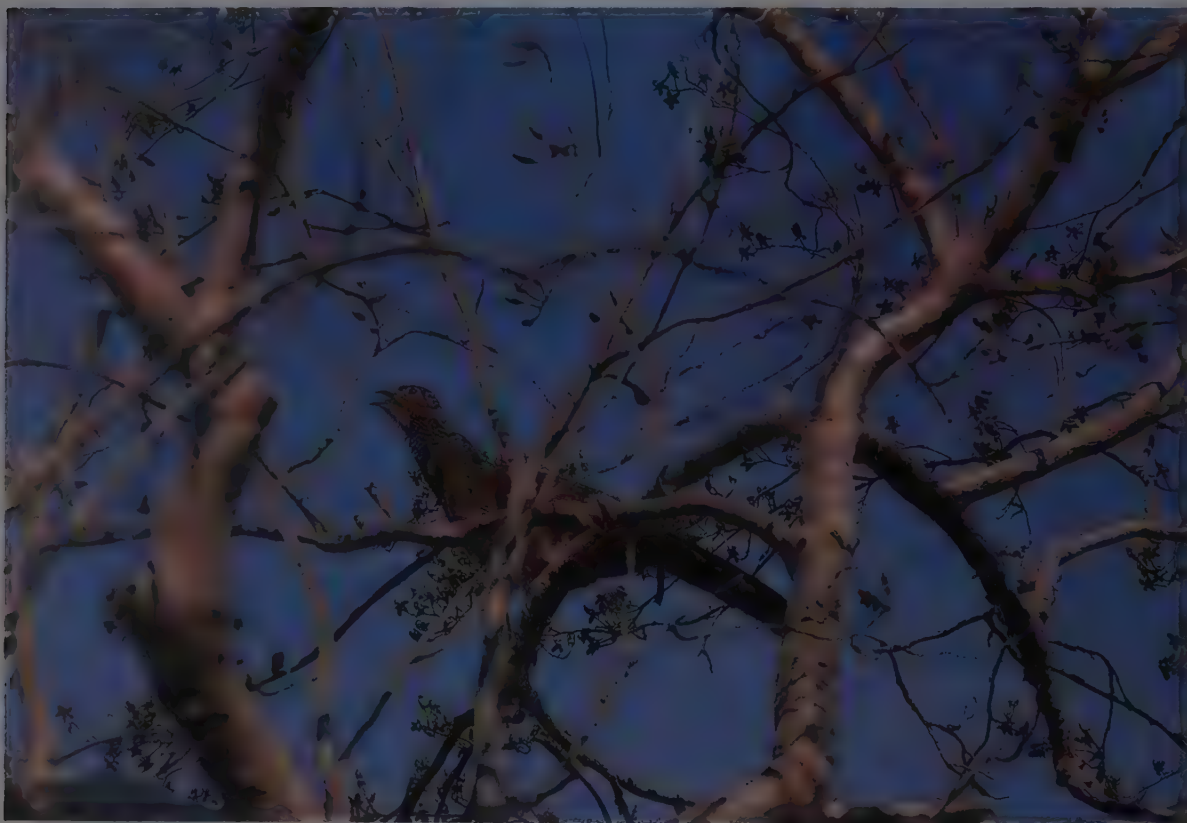
The breeding season varies with locality in the cracids. At the latitudinal extremes of the family's range, where there is a true spring, breeding tends to take place in this season. In the tropics, birds mostly breed during the wet season, although the breeding season is usually rather protracted; some species have no fixed breeding season, with birds laying almost at any time of year.

There are contradictory hypotheses about the reproductive strategy of the cracids. The guans and curassows were originally thought to be monogamous, whereas the more gregarious chachalacas were described as promiscuous and polygamous. However, Delacour and Amadon stated that all the cracids, except perhaps the Highland Guan, were actually monogamous. In support of this, most recent evidence on the chachalacas indicates that they form strong pair-bonds. The synchronized duet of the pair is performed more often when the pair is alone than when included in small flocks, and is typical of monogamous birds. Everything seems to indicate that, like other cracids, chachalacas are territorial, both members of the pair

Dust-bathing is a common activity amongst galliforms, and the cracids are no exception. This behaviour is better known in the Horned Guan than in any other member of the family, thanks to the studies carried out in El Triunfo Biosphere Reserve, in Mexico. The birds dust-bathe in treefall gaps, where the sun's rays reach the forest floor and dry the soil, and they normally do so once a day, between 12:00 and 16:00 hours. In addition to the well known functions of helping to keep the feathers in good condition and removing parasites, in this species dust-bathing appears to strengthen the pair-bond, as males have frequently been seen calling their females to the dust-bath during the courtship period.



[*Oreophaps derbianus*,
El Triunfo Biosphere
Reserve, Chiapas, Mexico.
Photo: Fernando
González-García]



Chachalacas are highly vocal birds which produce very loud calls and songs. The name "chachalaca" itself is onomatopoeic and refers not to the song of a single bird, but rather to the chorus produced when several birds sing together. Clearly visible in this singing West Mexican Chachalaca is the bright red bare throat, which must have similar sexual functions to the dewlaps of the guans, even though it does not dangle down in the same way. In this species, the bare orbital skin is also red, thus adding to the eye-catching effect.

[*Ortalis poliocephala*, Chamela, Mexico.
Photo: X. Ferrer
& A. de Sostoa]

normally defending the territory and confronting intruders. Chachalacas can be quite aggressive and conflicts can easily lead to fighting. Incubating females of the Rufous-vented Chachalacas may even leave the nest momentarily, to help the male expel an intruder.

Nevertheless, there appear to be some exceptions. In Costa Rica, A. Skutch observed a Grey-headed Chachalaca nest, where the incubating bird was indifferent to the approach of groups of conspecifics. Over a period of several days a mate was never observed, whereas in other species, although the male does not incubate, its presence in the vicinity of the nest is obvious. Perhaps in this case the other partner had died, but it might be that this species follows a different breeding strategy; indeed, it is the only chachalaca not to make the characteristic "cha-cha-lac-a" call of this group (see Voice). On occasion, chachalacas breed in loose colonies, and three occupied nests of the White-bellied Chachalaca were found in adjacent trees; the occurrence of several empty nests of the Plain Chachalaca in a small area might suggest the same thing, although they might not have been used simultaneously.

Until recently guans and curassows were thought to be monogamous, over one or possibly even many seasons, although most of the information came from captive birds. However, recent fieldwork has shown that, while monogamy does seem to be the norm, there are more exceptions than was previously thought. It was already noticed some time ago that in some species of curassow males tend to be accompanied by two or three females, but this was attributed simply to possible higher mortality amongst males. As males are more easily located by their calls, they could be more vulnerable to hunting pressure, and might also suffer higher mortality due to natural causes, as happens in some other monogamous birds. One such species is the Yellow-knobbed Curassow, which regularly occurs in groups of up to 15 birds in the dry season. In the *llanos* of Venezuela, R. Buchholz noted that the male does not appear to defend feeding territories or care for the chicks. Males performed vocal displays within earshot of one another, from calling trees at the edge of gallery forest. Females spent most of their time in the forest, but visited these calling sites singly or in groups, and were courted by the resident male. This

suggests that the species is polygynous, one male mating with several females in the same breeding season.

Over a period of seven days, three different female Horned Guans were seen in one male's territory: one of them was alone, and copulated with the male; another was accompanied by a one-week old chick; and the other had two 15-day old chicks. Although the probable polygyny seems to be at least partially simultaneous in this case, serial polygyny would explain the variation in breeding dates for different females in this species.

In the Amboró National Park, Bolivia, G. G. Cox and R. O. Clarke recently studied the very poorly known Southern Helmeted Curassow. They found that at the beginning of the rains the population, until then dispersed, forms small groups which then assemble at a site deep in the forest where males emit their booming song at a lek. After mating, the females apparently go off to nest alone. This system differs from that followed by the closely related Northern Helmeted Curassow, which is usually seen in pairs or family groups throughout the year. It is apparently monogamous in the wild, although a probable case of bigamy, with two occupied nests 130 m apart in the same territory, indicates that a particular species may not always stick to the same breeding strategy.

Although poorly known in many species, courtship in cracids includes some very peculiar activities, such as the wing-drumming flights of the guans, and the sophisticated ceremonies that some curassows perform on the ground. The courtship displays of chachalacas generally seem to be simpler, and probably include strutting and calling with the head erect, mutual preening, pecking, rapid chases and courtship feeding, all of which seem to occur equally on the ground or in the tree tops.

The wing-drumming or wing-whirring displays of the guans are unique among cracids, and, as far as is known, do not take place in the markedly distinct Horned Guan. Although in some species they may be produced throughout the year, they are more frequent during the breeding season and in some species are limited to this time, showing that they are clearly related to breeding. They are performed very early in the morning, when it is still dark in the forest, making detailed study difficult.



The chorus of the Rufous-vented Chachalaca can be heard on most mornings during the breeding season. It starts after sunrise, often an hour or two afterwards, and is kept up almost without interruption for at least half an hour, and sometimes for over two hours. Once the chorus has finished, normally between 09:30 and 10:30, there may be further short outbursts, normally of less than five minutes, at any time of day, and on occasions there is another relatively lengthy session in the late afternoon. The song and calls of the male of this species are lower-pitched than those of the female, and with experience it is possible to distinguish the sexes by voice.

[*Ortalis ruficauda*.

Photo: Christian Zuber/
Bruce Coleman]



This Spix's Guan was photographed at a salt lick which is also frequently attended by other birds and some mammals. Various species in this family have been seen ingesting a particular kind of clayey soil that is to be found only in particular places. It seems that, like many parrots, some cracids add a mineral supplement to their diet.

[*Penelope jacquacu jacquacu*, Peru.
Photo: Günter Ziesler]

This display is carried out during a special flight. In general, the bird flies off its perch in a tall, emergent tree, glides in the open for about two seconds, and produces the wing-whir for about three seconds by beating the wings twice as fast as in normal flight; it then glides on to another, similar perch, generally lower down. These flights are usually over a distance of 50-175 m, although on abandoning the display area, a bird sometimes drums and continues to fly for longer distances. Sonagrams have shown that the wing-whir itself is divided into two portions separated by a pause of less than half a second. In the first part the wingbeats speed up, but at the end of the second they slow down again. The same individual usually makes its display several times in the same session, using different perches each time.

There are slight differences in the display between different species of *Penelope*; for instance some whistle just before drumming. In the piping-guans the display is similar, but at the moment of take-off they make one or two loud wing-claps, after which they immediately wing-whir. Another difference in this group is that the first portion, before the pause, is longer than the second, the opposite of what happens in *Penelope*. In addition, the more elaborate modification of their outer primaries (see Morphological Aspects), and the fact that their wingbeats are faster, makes the sound much sharper and drier. So, if wing-drumming in *Penelope* recalls a series of dull thumps, or the ruffling of a drum, the wing-whirring of *Pipile* is like the sound produced by ripping a piece of thick cloth. The latter also carries further, and can sometimes be heard more than a kilometre away. While flight displays stop before dawn in *Penelope*, they can carry on into the morning and even in full daylight in *Pipile*. All species occasionally drum at unusual hours, for example on an overcast day or in the middle of a moonlit night.

Wing-drumming displays are used to maintain the pair-bond and perhaps also to help in pair formation. If there is any territorial function, it seems to be secondary. In the Crested Guan the display seems to be performed by the male only, although in the presence of his mate, and the same may occur in other species. It should be noted, however, that the modifications of the wing quills are present in both sexes.

The curassows perform fairly elaborate displays on the ground, although the Yellow-knobbed Curassow has been seen flapping its wings loudly and repeatedly, while it whistles its song from a tree top. The most elaborate display recorded in the wild is that of the Black Curassow, described by W. Beebe at the beginning of the century. The bird, almost certainly a male, adopted a spectacular posture while it walked slowly through a clearing in the forest in front of two other birds, possibly females. The presumed male leaned forward with its breast very low and the bends of the wings drooped downwards. The head and the tail were raised, with the tail pointing straight up and the white of the abdomen and undertail-coverts noticeably fluffed out, contrasting with the otherwise black plumage. From time to time, the bird stopped to pick up a pebble and hit its head violently against its back, with a clicking sound. Immediately afterwards, it dropped the pebble and clapped its wings seven or eight times. After several convulsive movements, it adopted a half-squatting posture, with the head and the tail low, and made a booming call. The bird observed by Beebe repeated the display in every detail five times in twelve minutes.

Information on the displays of other curassow species comes mainly from captivity. The Great and Red-billed Curassows perform displays quite similar to those of the Black Curassow, but somewhat simpler. A male Blue-billed Curassow repeatedly caught and threw pebbles, and male Wattled and Northern Helmeted Curassows will trot in circles round females. Courtship feeding has been recorded in the Nocturnal, Salvin's, the Great and the Bare-faced Curassows. The fact that none of the displays described for other species is as complex as that of the Black Curassow may be due to insufficient observations or because courting is inhibited in captivity, but it may also be related to the reduced sexual dimorphism in this species, the least marked in any species of *Crax*.

In curassows and chachalacas copulation usually takes place on the ground, although Chaco Chachalacas (*Ortalis canicollis*) have been seen copulating in tree tops, and this may also happen in the most arboreal guans. Male cracids have a penis-like organ.



In the curassows, courtship normally takes place on the ground and may include quite sophisticated ceremonies, involving a series of movements which are normally performed in a regular sequence, with none of the constituent parts omitted. Wing-flapping is one of the most frequently recorded actions, and, as illustrated by this male Bare-faced Curassow, it helps to highlight the contrast between the generally black plumage and the white lower abdomen, which in normal conditions is very inconspicuous. Courtship feeding has also been observed in various curassow species. The male picks up a food item and then turns his head to one side and waits, sometimes for some considerable time, until the female comes and takes the food from his bill.

[*Crax fasciolata fasciolata*,
Das Emas National Park,
Brazil.

Photos: Günter Ziesler/
Bruce Coleman]



Cracid nests are nearly always built in the vegetation, and there are very few documented records of nests built directly on the ground. The Plain Chachalaca's nest is a rather flimsy structure built of broken off sticks and twigs. Green leaves are often used for lining the inside of the nest, and they are also typically incorporated into the main nest structure itself. The nest is small in relation to the size of the bird, as is the norm in this family.

[*Ortalis vetula vetula*, Chiapas, Mexico. Photo: X. Ferrer & A. de Sostoa]

Both members of the pair participate in nest building, although in some species the male may do most of the work. In captivity, the nest is sometimes built by the male only, but this has been interpreted as a sign that the female was not in breeding condition. In contrast, some of the few nests known of the Northern and the Southern Helmeted Curassows were apparently constructed entirely by females.

The nest is almost always situated in vegetation, in a tree, shrub or vine, in some cases up to 20 metres above the forest floor, but usually quite a lot lower. Often the nest rests solidly on the top of a broken snag, on an accumulation of dead leaves in a large fork, on a thick palm frond, on the leaves of a bromeliad, on an arboreal termite nest, or even on one of the birds' old nests. There are many old reports of nests being built directly on the ground, but most are now considered dubious, and the habit has only been confirmed for the Highland Guan and the Rufous-vented Chachalaca. In the latter, two out of six nests were on the ground. In the former, the first nest found was on the ground under a log, from which it was deduced that this was the norm for the species. Later, of 16 nests found at one site only one was on the ground, and it had been deserted. Both the Rusty-margined Guan and the Black-fronted Piping-guan occasionally nest on large rocks in the forest.

The nest is usually in the form of a flat dish and is small in proportion to the size of the birds, especially when it is built on a solid base, such as a stump, in which case it is flimsy and misshapen. It is loosely built from sticks, twigs, creepers and other coarse materials, especially varied in the chachalacas which also tend to include grass stems tucked in at the sides. Often nests also contain green leaves, sometimes many, which make the structure more compact when they dry off. The cup is sometimes lined with fresh vegetation.

The eggs, generally laid on alternate days, are white or cream coloured, and are not marked at all, although they are sometimes strongly stained by the green vegetation on which they rest, particularly in wet weather. Their surface is pitted, strongly in the curassows and somewhat less in the chachalacas, but it is smooth in some guans. However, there are sometimes

marked differences between different clutches of the same species, or even between different eggs of the same clutch. Eggs are large in proportion to the size of the bird, although the differences between the several groups are considerable: while the average egg size of the Great Curassow is 92 x 67 mm, that of the Plain Chachalaca is 58 x 41 mm. Clutch size is small, in contrast to the more typical Galliformes. Curassows usually lay two eggs, while chachalacas and guans usually lay three, or occasionally four. Clutches of only one egg have been recorded in curassows, and of only two in chachalacas and guans, but some of these clutches may have been incomplete. A Plain Chachalaca nest found in Texas containing nine eggs was undoubtedly the result of several females laying in the same nest.

There is insufficient information available to establish whether or not cracids lay replacement clutches in the wild. They probably do, as in captivity they manage to lay four or more in a season, if the eggs are regularly removed. Without interference, some species, such as the Dusky-legged Guan, can lay two clutches annually.

Incubation is carried out by the female alone. During this period, the male Rufous-vented Chachalaca often remains watchful in the vicinity of the nest, but rarely actually in the nesting tree, except when it is necessary to expel an intruder. The female sometimes leaves the nest during the day, in order to feed, often in the company of the male. In the same species this occurs three or four times a day, five at the most; she is normally absent for slightly over an hour, seldom more than two, and clearly for shorter spells than her incubation stints, which often last more than three hours. If it begins to rain while the female is away, she quickly returns to protect the eggs from the rain. A female Horned Guan left her nest three times a day, in the morning, the middle of the day and the afternoon, and another did so four times, but less as hatching approached, perhaps partly due to the heavy rain that happened to fall on those particular days. A female Northern Helmeted Curassow did not leave her nest more than once a day, generally in the morning for one to two and a half hours; on very rainy days

One of the differences between cracids and other galliforms is their small clutch, which normally consists of two eggs in the larger species and a maximum of four in the chachalacas. The eggs are relatively large, and are white or cream-coloured without any kind of pattern. Incubation is performed exclusively by the female, and in the case of the Horned Guan lasts between 34 and 36 days, one of the longest incubation periods of any cracid. The nest of this species, built high up a tree, is rather rudimentary, and is small in comparison with the size of the bird.

[*Oreophasis derbianus*,
El Triunfo Biosphere
Reserve, Chiapas, Mexico.
Photo: Fernando
González-García]



she would not leave the nest at all. Sometimes incubating females will add some material to the nest. During the hottest hours the incubating bird tends to pant actively in order to dissipate heat, and she often preens while sitting on the eggs. Incubation lasts about 24 days in chachalacas, 28 in guans, and normally 29-32 in curassows, with some variation between species; for instance in the Northern Helmeted Curassow it can exceed 34 days.

The chicks are relatively large and robust, so hatching is fairly rapid, apparently without the resting periods that typically occur in other birds. In captivity, it has been noted that after a curassow chick pips the egg it takes no more than two or three hours to emerge totally. At two nests watched in the wild, one each of the Grey-headed Chachalaca and the Horned Guan, the process was virtually simultaneous, with all of the eggs hatching within the space of one or two hours. Synchronous hatching has also been confirmed in the Plain Chachalaca. Chicks are covered in down with a variegated pattern, mainly pale brown and black, that serves well as camouflage. The down is heavy and dense, especially in mountain species, and the quills of the primaries and secondaries have already sprouted at hatching. Chicks continually make soft peeps, starting even a day or more before hatching. They are highly precocial, and leave the nest a few hours to one or two days after hatching. Heavy rain can sometimes delay departure from the nest, as may have happened with two Horned Guan chicks that stayed put for six days. When they leave they are already capable of grasping branches and perches, although at first they can have difficulty keeping their balance. They are skilful at climbing through the vegetation and can flutter for short distances at three or four days old.

Both sexes brood the chicks on the roost, except in the curassows and the Horned Guan, where this task is carried out only by the female. During the night the adult normally protects the small chicks by sheltering them under a half open wing, sometimes with one chick under each wing. A female Great Curassow has been recorded feigning injury in order to distract the attention of possible predators from her chicks.

In other Galliformes chicks feed themselves by picking up little bits of food that they find by wandering about, but cracid chicks are fed by their parents, or only by the mother in some species. The adult offers them food in the tip of the bill, either regurgitated, in chachalacas and guans, or not, in curassows (see Food and Feeding). Soon the chicks gradually begin to feed themselves, although when they are half-grown they still continue to receive food from their parents from time to time. One adult Rufous-vented Chachalaca was seen making palm fruits fall, apparently deliberately, for half-grown chicks that waited on the ground below to eat the fruit. Although they remain in loose flocks for a considerable time, young chachalacas and guans become comparatively independent of their parents more quickly than do curassows. Young Red-billed Curassows, for example, remain practically inseparable from their mother until they are more than four months old.

The age at which cracids reach sexual maturity is not definitely known. Data from captivity and the capture of birds not in breeding condition during the breeding season, suggest that breeding normally starts at two years of age, and this has been confirmed in some female Red-billed Curassows, although other conspecifics do not seem to begin until they are three. However, chachalacas, given their small size, are probably ready to breed at one year old. There may also be differences between the sexes, as experience in captivity suggests that male Horned Guans need four years to become sexually mature, whereas some females can breed after only one.

Virtually nothing is known of breeding success in this family. One exception is the Plain Chachalaca, in which successful nesting was recorded in 65% of 135 nests studied over four years in the Santa Ana National Wildlife Refuge, Texas; 4% were abandoned; and 30% destroyed, mainly by mammalian predators, such as raccoons (*Procyon lotor*) and opossums (*Didelphis marsupialis*), and also by snakes. Trinidad Piping-guans are also said to suffer some nest predation by snakes, while two Crested Caracaras (*Polyborus plancus*) were seen plundering a Chaco Chachalaca's nest in Bolivia. Other birds of prey, jays and monkeys also undoubtedly rob cracid's nests



The White-crested Guan is generally reckoned to be the most handsome member of *Penelope* due to its more contrasted, colourful plumage. This species has a fairly small range in Amazonia, where it appears to be restricted to areas of dense, pristine forest. For this reason, despite the lack of any evidence of a decline, the species is currently considered to be near-threatened. It has been bred sporadically in captivity in various zoos and is at present the subject of a captive breeding programme in the Cracid Breeding and Conservation Centre, in Belgium.

[*Penelope pileata*.
Photo: Josep del Hoyo/
Lynx]

occasionally. The young are assumed to suffer high mortality, especially due to predation by both birds and mammals, and, like all gamebirds, cracids tend to be favourite prey species. Predators include: several species of jungle cat; larger mustelids, like the eira (*Eira barbara*); the Ornate Hawk-eagle (*Spizaetus ornatus*), known as "Curassow Hawk" in places; Harris's Hawk (*Parabuteo unicinctus*), which has been seen killing guans in different areas; the Collared Forest-falcon (*Micrastur semitorquatus*), which seems to capture West Mexican Chachalacas frequently; and the Black-chested Buzzard-eagle (*Geranoaetus melanoleucus*), which has twice been seen recently catching White-winged Guans, a threatened species. However, once cracids reach maturity, they are thought to be fairly long-lived, especially the curassows. In captivity, a female Great Curassow died at 24 years old, having laid eggs until she was 23, and there are several other records of birds over 20 years old, including Razor-billed and Wattled Curassows. Despite the effects of predation and low productivity, cracids maintain their numbers well where they are not persecuted by man.

Movements

All cracids are essentially non-migratory, although some local movements occur in many species. Perhaps the most regular movements are the vertical ones undertaken by several of the mountain species. The Andean, Wattled and Sickle-winged Guans, and maybe also the Northern Helmeted Curassow, seem to perform some seasonal altitudinal movements that may be related to the search for available fruit. Outside the breeding season, the three guans have all been recorded above or below their normal altitudinal ranges on various occasions, and similar movements have also been noted in lowland species that occupy more mountainous areas in parts of their ranges. Such are the cases of the Crested Guan in some areas of Colombia, of

the Dusky-legged Guan in north-west Argentina, and of the Black-fronted Piping-guan in Brazil. This last species, now extirpated from most of its original range (see Status and Conservation), used to migrate vertically in the Serra do Mar, São Paulo, in connection with the availability of palmito fruits that ripen earlier in the lower areas. In fact, similar movements still occur in the population that inhabits the Ilha do Cardoso State Park, where the species is present at altitudes of 100-900 m.

Other kinds of movement noted in some cracids are connected with wet seasons. The White-winged Guan concentrates in evergreen thickets at the height of the dry season, and at some of the localities where it persists, it is only present at certain times of year. In the Sierra de Macarena, Colombia, Salvin's Curassow retires during the dry season to valley bottoms or woody gullies where there is still water. The concentrations of Yellow-knobbed Curassows during the dry season at the remaining pools in the Venezuelan llanos are also well known.

Other, more typical migratory movements related with seasonal changes of temperature are also known. The Black-fronted Piping-guan's range, because of its latitude, is more affected by climatic seasonality than are those of most other cracids; indeed, at the turn of the century it was apparently migratory in south central Rio Grande do Sul, Brazil. It appeared in the area between May and June, and after breeding there left in December. It also appeared seasonally in Santa Catarina, in March and April, with the ripening of the fruits of the pindaúba (*Xylopia*), an important component in its diet. Normally birds arrived in small groups, but in years with abnormally cold winters there were veritable invasions of the species. They seem to have moved in groups of 4-16 birds. Thus, although the drastic decline of the species now masks the fact, this species is probably the cracid most prone to authentic migration. Its congeners may share a certain tendency to migrate, as both the Trinidad and the Blue-throated Piping-guans move over large areas in search of fruit, and

the latter even migrates locally up or down rivers in Mato Grosso, Brazil.

Relationship with Man

The cracids have always been well known to local human populations. Maya remains bear witness to this, with cracids featuring on various archaeological finds, and on pictograms and manuscripts. The peninsular Maya language has names for each of the cracid species present on the Yucatán Peninsula, and different names for the male and the female of the two species with marked sexual dimorphism, the Highland Guan and the Great Curassow. It is also believed that a cracid, probably the Crested Guan, was the "bird of dawn", a legendary bird of great importance in Mayan mythology, that was later substituted by the Spanish-introduced cockerel. In Mayan tradition, the "bird of dawn" was created apart from other animals to act as a sentinel, to announce when Kisin, the "Lord of Death and Darkness", struck Hachakyum, the chief Sun god. Each morning, at that moment of apparent indecision between light and darkness, the call of the "bird of dawn" would warn the son of Hachakyum, who would come to rescue his father and defeat Kisin. The great influence of Mayan culture probably explains why representations of cracids also appear in other areas of Central America.

The Mayan legend of the "bird of dawn" suggests one of the principal reasons why cracids do not go unnoticed by their human neighbours: their remarkable vocalizations (see Voice). This is particularly so in the case of the noisy chachalacas, as their songs are often "interpreted" by the local people, who put words to them, which, when repeated quickly, mimic the songs quite well. In Colombia, for example, the female Chestnut-winged Chachalaca is said to ask the male "¿Se cae la casa?", (Is the house falling down?), to which he replies "¡No se cae, no se cae!" (No it's not, no it's not!). In the Mato Grosso of Brazil, the song of the Chaco Chachalaca is interpreted as "Quero casar pelo natal" (I want to marry at Christmas).

Another obvious aspect of man's close relationship with cracids is the fact that these birds are nearly always among the favourite targets of local hunters. This has been so since ancient

times, as shown by Mayan use of their feathers for arrows and their flesh for food. Their Lacandón descendants and nearly all the local peoples in the cracids' range continue these uses to this day. The meat of various species has often been described as excellent, although this opinion is not unanimous, and the large, strong tail and wing feathers make excellent fletches for arrows. Chachalacas, which inhabit more open, settled areas, are particularly exposed to this persecution and are also popular amongst sport hunters because, although they do not offer good wing shooting, their hunting requires long waits and challenging tracking. Paradoxically, however, the chachalacas are the cracids which best withstand hunting pressure, and are almost the only members of the family for which hunting does not constitute a serious threat (see Status and Conservation).

Over the centuries, cracids have also been caught to be kept in captivity. In some areas it is particularly common for tame curassows, guans or occasionally chachalacas to be kept like poultry in villages. If they are kept with chickens, however, they will often attack or even kill them. The claim that a cross between a chachalaca and a chicken results in an excellent fighting bird has no basis, as no hybrids of Cracidae with any member of any other family have ever been reported scientifically. Given their large size and striking appearance, cracids are also highly regarded by aviculturists, though less so in the case of the less handsome chachalacas. There are records of cracids being exported to Europe in the seventeenth century. The curassows owe their name to the fact that the first of these birds to arrive in Europe were sent from the island of Curaçao, in what is now the Netherlands Antilles, whence they had no doubt been imported from other areas, as cracids do not live wild on this island.

After their arrival in Europe, it was thought that their domestic breeding might be profitable, given their great size and their more trusting nature than, for example, turkeys (*Meleagris*). Attempts to do so failed, however, due largely to their small clutch size, their vulnerability to low temperatures, which very quickly freeze their feet, and the fact that most species are apparently monogamous. Nonetheless, they are not particularly difficult to breed, especially in temperate or hot climates, and more than half of the species have now been bred successfully in zoos or private collections. The survival of some of the most

The Black Guan is another species which is considered to be near-threatened essentially because of its restricted range. It is found only in the mountains of Costa Rica and Panama, where a great deal of its habitat has been destroyed or has undergone major transformations; in addition, the species is intensively hunted for food in many areas. Fortunately, it is still locally common in some of the remoter parts of its range and in a few protected areas, most notably in the Monteverde Cloud Forest Reserve, where its density was recently estimated at four pairs per square kilometre.

[*Chamaepetes unicolor*,
Monteverde Cloud Forest
Reserve, Costa Rica.
Photo: Michael Fogden/
DRK]



threatened species indeed relies on various programmes of captive breeding (see Status and Conservation), although the capture of birds for trade has been decidedly detrimental for several species.

Status and Conservation

There are still some large gaps in what is known about the Cracidae, including basic aspects of their biology. It may seem rather surprising, therefore, that their status, at least at a general level, is fairly well known. This is in part due to the co-ordination and exchange of information between most field researchers working on cracid species under the auspices of the ICBP/IUCN International Cracidae Specialist Group. This co-operation allowed the chairman, S. D. Strahl, to prepare a detailed Action Plan in 1990, listing each species' status and conservation priorities, country by country. Another contributing factor was the publication in 1992 of the ICBP/IUCN Red Data Book for the Americas, under the direction of N. J. Collar. All information available about threatened Cracidae, a family endemic to the region, was thus comprehensively drawn together.

With all the information to hand, it is clear that the status of the chachalacas is quite different from that of the guans and curassows. Thus, none of the twelve species of *Ortalis* is currently considered globally threatened, and only the Rufous-headed Chachalaca (*Ortalis erythroptera*) is listed as near-threatened. Of the 24 species of guan, however, seven are classed as threatened, the Bearded, Cauca, White-winged, Chestnut-bellied and Horned Guans and the Trinidad and Black-fronted Piping-guans; another seven, the Baudo, Red-faced, White-crested, White-browed, Wattled, Black and Highland Guans, are considered to be near-threatened. The situation of the curassows is even worse: six of the 14 species are threatened, namely the Alagoas, Blue-billed, Wattled and Red-billed Curassows and the Northern and Southern Helmeted Curassows, and these include the most severely threatened members of the family.

The difference in status between the chachalacas and the other cracids can be explained by their differing habitat requirements (see Habitat). As guans and curassows are basically forest species, often dependent on primary forest, they are seriously affected by any alterations implying some degree of deforestation, a process which is taking place, to a greater or lesser extent, throughout the Neotropics. In fact, habitat destruction is causing declines, and even local extinctions, in nearly all species of guans and curassows, not just the threatened species. Differences in overall status are due, to a great extent, to the sizes of each species' range and whether this range includes sufficiently large areas of habitat that is protected, by the remoteness of the area, the inaccessible nature of the terrain, or, more rarely, efficient conservation measures.

The chachalacas, on the other hand, avoid dense forest and are even favoured by some of these changes, often appearing in areas where they did not occur until the primary forest was cleared or converted into plantations. When habitat destruction is very severe, however, it also leads to the disappearance of chachalacas, and this has led to marked local population declines in many species. This danger is, of course, greater in species with more restricted ranges, so it is not surprising that the Rufous-headed Chachalaca is the least secure of the chachalacas, as it is the most localized species, restricted to the now heavily transformed lowlands of western Ecuador.

Following habitat destruction, the second most important threat to cracid survival is hunting, be it for food or feathers, for trade or for sport. Several studies show that cracids constitute the largest avian biomass taken by the various kinds of hunters in Neotropical forests.

These two factors combined, habitat destruction and hunting, are nearly always sufficient to account for the delicate situations of the threatened species in the family. All three natural groups are subject to a greater or lesser degree of hunting, but their ability to withstand it is quite different. The wary chachalacas, accustomed to moving through open habitats, are able to survive even in areas where they are hunted intensively throughout the year. The guans and particularly the curassows, however, are very sensitive to hunting pressure and tend to disappear rapidly from the vicinity of settled areas. There are several reasons for their extreme vulnerability to hunting: their large size; the ease with which they can be located when making their courtship vocalizations, a period when persecution is particularly harmful; the trusting nature of many species when they are not used to persecution; and their low productivity, much lower than in the vast majority of Galliformes (see Breeding). A quantitative estimate of how curassow populations are affected by hunting was obtained by J. M. Thiollay in French Guiana. The estimated density of Black Curassows in areas where there was no hunting within 50 km or more was between 7.28 and 9.46 birds/100 ha; in zones with hunting 3-20 km away, it fell drastically to between 0.51 and 2.25; but it slumped to between 0.05 and 0.73 in regularly hunted areas.

Of all the threatened cracids, the Wattled Curassow is perhaps the least known in terms of status, and it is the only one classed as Indeterminate. Although it is not known ever to have been common, in the few areas of its range for which there are old estimates and where field work has recently been carried out, comparisons of the figures consistently show serious declines, or even that the species has disappeared completely from the area in question. In fact, despite the increase in ornithological exploration in recent times, there are more records of the species in old texts than in works written during the present century. On the other hand, some recent records show that the species inhabits some areas where it was hitherto unrecorded. The species has been hunted intensively in Peru and northern Bolivia, and almost certainly in many other areas. In addition, particularly in Brazil, the destruction of large areas of *várzea* forest, a habitat particularly favoured by the species, must also have played an important part in its decline. Nevertheless, there are still large areas within its range which are well conserved, so the causes of its apparent overall decline are still, therefore, not well understood.

The Bearded Guan of south Ecuador and north Peru has one of the smallest ranges of any cracid, in a region where forest destruction has been severe.

The species is classified as Vulnerable/Rare, and its future may be bound up with that of its main stronghold, the Podocarpus National Park, a protected area which is currently suffering from the presence of many casual gold prospectors.

[*Penelope barbata*.
Photo: Josep del Hoyo/
Lynx]



Despite a marked regression, the White-browed Guan manages to survive in areas of dense human population, thus indicating a certain capacity for adaptation, and it is presumably for this reason that it is only considered near-threatened. As so often, the combination of habitat destruction and hunting pressure is responsible for its decline.

[*Penelope jacucaca*,
Brazil.
Photo: Haroldo Palo/
NHPA]



Two species, the Cauca Guan and the Red-billed Curassow, both have very small populations in restricted ranges. Thus, although these populations are largely protected, both are classified as Rare, and are thought to require close monitoring.

The Cauca Guan is almost completely restricted to the middle and upper Cauca Valley, in western Colombia, where the humid forests inhabited by the species have been widely destroyed. This destruction, almost certainly in conjunction with hunting, led to such a steep decline that in the 1970's and the early 1980's the species was thought to be on the verge of extinction. Subsequently, however, at least three small, apparently stable populations have been found in protected areas. The first priority now for their conservation is the elimination of poaching that still goes on in two of these three protected areas, while further surveys may show that the species still survives elsewhere.

The Red-billed Curassow also has a limited range in a highly transformed area, in this case the lowland Atlantic forest of Brazil. Although it was apparently fairly widespread in the past, the intense forest destruction in this area, combined with direct persecution of the species particularly for trade, has devastated the population, now estimated to total a few hundred birds. They survive in six or seven forest patches, five of which are in protected areas; the bulk of the population inhabits two of these areas, the adjoining Sooretama and Companhia Vale do Rio Doce Reserves in Espírito Santo. However, the recent extinction of some populations in theoretically protected areas demonstrates the uncertain future of this species.

This same species is one of the cracids with the largest populations in captivity, where it has been bred successfully, and to date it is the only species being reintroduced experimentally. Of the 400-450 birds in captivity, over half are at the Fundação Crax, near Belo Horizonte in Minas Gerais; this was started from the private collection of the Brazilian aviculturist R. Azeredo, with the financial and technical aid of Stichting Crax in the Netherlands, and the Cracid Breeding and Conservation Centre in Belgium. The high breeding success of this stock has enabled the reintroduction of some birds to the wild. In December 1990, following a six-week quarantine period, 15 pairs, which had been raised together and were about 18 months old, were put in a huge aviary in an area of 1460 ha of regener-

ating rain forest owned by the company CENIBRA near Ipatinga, Minas Gerais. They were kept here for ten months, while their diet was gradually changed until it consisted basically of leaves, shoots and fruits of plants growing in the release area. After their release their adaptation to their new surroundings was carefully monitored: within a year four birds had been killed by predators; one had died due to unknown causes; and two had been captured by poachers, even though the reserve was closely watched by guards, and despite educational programmes carried out in neighbouring areas. Nevertheless, over 20 birds survived in the reserve, apparently well adapted, and several males were seen performing breeding displays. In July 1993, another 37 birds were introduced into the aviary in preparation for a second release at the end of the year. This time the birds were to be marked with colour rings to allow individual recognition and some were radio-tagged so that they could be tracked. The project has received some criticism, because it is not known whether the species previously inhabited the area and because of habitat deficiencies, but there is much value in examining the difficulties and potential of reintroduction from captive stock. This is particularly true given that the survival of several cracids could depend on the success of this type of programme.

The populations of another five declining cracids are only partly protected, and these species are considered Vulnerable. They are the Bearded, Chestnut-bellied and Horned Guans, the Black-fronted Piping-guan and the Southern Helmeted Curassow.

The Bearded Guan, with a fairly limited range in the humid montane forests of southern Ecuador and adjacent north-western Peru, was considered to be common at the turn of the century, but has now been reduced to a few populations which are thought not to exceed a few thousand birds in total. The sharp decline is due to the destruction of large areas of its habitat, and the species' particular vulnerability to hunting due to its confiding nature. Only one of the currently known populations is protected, in the Podocarpus National Park in southern Ecuador. The situation would have worsened drastically, but the concessions for open-pit mining covering 99% of the park, were withdrawn in 1993, following a determined campaign by various conservation bodies, including BirdLife International (ICBP). Unfortunately, the opening up of trails in



previous years had already made access to the park easier for poachers and casual gold prospectors. It has been estimated that in 1993 some 200-500 of these miners were digging illegally in the park and had deforested some areas. Increased conservation efficiency in this park and the creation of other reserves in various parts of Ecuador and Peru are essential for the survival of this and other species of the region, one of the areas of highest endemism in all South America.

Very little is known about the Chestnut-bellied Guan; indeed, there have been remarkably few records. It is scattered over a wide area of central Brazil, but its specific habitat requirements are not known. Nor have the exact causes of its apparently low population been identified, although it is very possible that, like most species in this family, it suffers hunting pressure; it has probably also been negatively affected by the agricultural developments within its range. On the other hand, it may be a species which is naturally very localized or very secretive. In any case, there is the alarming fact that it has only been reported from one protected area, the Araguaia National Park, in Tocantins, where it is believed to live in small numbers. Surveys to delimit its current distribution and status are the first priority for its conservation.

In terms of status, the Horned Guan is one of the species about which most has been written. Despite a very limited range, in southernmost Mexico and adjacent western Guatemala, various reports show that it was fairly common at the end of the nineteenth century. It has undergone a steady decline in the twentieth century due to the destruction of its humid montane forest habitat, mainly for farming and coffee plantations; and also due to hunting, as these large, confiding birds are especially vulnerable, and pressure intensified as the number of coffee plantations increased, the birds being a tempting source of food for the workers. By the end of the 1970's it was estimated that the total population was below one thousand birds. The recovery of this highly distinctive bird was one of the ideas behind the creation of El Triunfo Biosphere Reserve, in Sierra Madre de Chiapas, which managed to stop the destruction of forest that had been being carried out by settlers throughout the 1960's. This was accompanied by the setting up of a global conservation programme, supported by the Brehm Fund and Wildlife Conservation International. In 1987, the Mexican ornithologist F. Gonzalez-Garcia began a long-term study into the species' biology and ecology which has now made it one of the best known of all the Cracidae. Since 1988, local educational campaigns have been carried out in the villages near the reserve. A captive breeding programme is also under way in the private collection of J. Estudillo, near Mexico City. After several years in which only infertile eggs were laid, the study of the species' dietary needs, of bird management techniques, and of artificial incubation of eggs has resulted in

considerable success, 15 birds being raised to maturity between 1989 and 1992. If the habitat is conserved, some of the areas where the species has been eradicated by hunting may be repopulated in the future. The symbolic significance of the Horned Guan has encouraged the setting up of a few protected areas in Guatemala too, although large proportions of the surviving populations in both countries are found in areas with no form of protection; preserving these areas is the maximum conservation priority for this species.

Another species that has aroused much interest is the Black-fronted Piping-guan. It is another victim of the devastating destruction that has taken place in the Atlantic forest of eastern Brazil and adjacent eastern Paraguay and north-eastern Argentina, combined with extremely intense hunting pressure. These two factors have resulted in a marked reduction of the species' range, from the northern half of which it has practically been eliminated; they have also led to a drastic decline in overall numbers. In the scattered sites where it still survives it is now rare or very rare, but there is evidence that it was formerly abundant, at least in some areas: the record of about 50,000 birds killed in an area of Santa Caterina during a few weeks in the cold winter of 1866; and photos of "pyramids" of birds taken by hunters in Paraná in the 1930's. It is very likely that this species' migratory habits and its partiality for the fruit of the palmito (see Movements, Food and Feeding), a palm often exploited by man, hinder its conservation in the generally small pockets of forest that remain in this region. Small populations of the species still survive in various protected areas, but its recent extinction in Sooretama Reserve, Espírito Santo, apparently due exclusively to poaching, shows the limited safety this implies. There are also populations in areas without any form of protection in all three countries of its range. The creation of reserves in these areas and the improvement of conservation measures in those already existing must be the main priorities to ensure the survival of the species. With these aims achieved, already successful captive breeding programmes might allow some reintroductions or the reinforcement of some populations with low numbers. Again, the reserve of Sooretama serves as a warning of potential difficulties, as an attempt to reintroduce the species there in the 1970's failed.

The Southern Helmeted Curassow is a species about which hardly any information had been gathered until very recently. It was not discovered until 1937, in the Yungas de Cochabamba, central Bolivia, and only four specimens were known of until the 1960's. In 1969, however, another two birds were collected in the Cerros del Sira, eastern Peru, over 1000 km to the north of the area in which the species was hitherto known, and they were described as a new subspecies. Although they are known to be hunted by both natives and professional hunters, the



This is one of the first chicks hatched in a captive breeding programme of the White-winged Guan that is being carried out in north Peru, very close to the natural range of the species. Classified as Endangered and judged to be in a critical situation, this species may have a maximum population of only a few hundred birds.

[*Penelope albipennis*.
Photo: Gustavo del Solar]

There is ample evidence to suggest that the Black-fronted Piping-guan was once a most abundant species. It is now seriously threatened, principally due to the extensive destruction of the Atlantic forests of Brazil, to which the bird is endemic. It is currently kept in captivity in several zoos and institutions, where it is bred without too much difficulty.

[*Pipile jacutinga*.
Photo: Josep del Hoyo/
Lynx]

The Northern Helmeted Curassow, another endangered cracid, suffers pressure from indiscriminate hunting, both for food and for its "helmet", which is used by the local Indians for making necklaces. These "trophies" were displayed on the wall of a bamboo hut in western Venezuela.

[*Pauxi pauxi pauxi*,
Venezuela.
Photo: Luud H. M.
Geerlings]



The status of the Southern Helmeted Curassow is amongst the least known of all cracids. Nevertheless, the paucity of records of the species since its discovery explains why it is classified as Vulnerable/Rare. The species is kept in captivity only in the aviaries of J. Estudillo, near Mexico City, where it has been bred successfully.

[*Pauxi unicornis unicornis*.
Photo: Josep del Hoyo/
Lynx]

reason for their rarity is unclear, and this may well be a naturally rare and localized species. Another factor to consider is the very limited amount of ornithological field work carried out in this region, which has no doubt contributed to the fact that such a remarkable species has gone almost unnoticed. This situation started to change in 1987 when Cox and Clarke began their study (see Breeding) on the species' status and requirements in the Amboró National Park, Bolivia, the only protected area in which the species is known to occur. It was found that a reasonably large population lived and bred in this park of 180,000 ha, and anti-poaching measures were stepped up, probably leading to the slight increase in numbers detected very recently. In addition, much new information about the species was collected, for instance about its vocalizations, local movements and breeding behaviour, including the discovery of the first nest. This information may also be useful for the protection of the species in other parts of its range. In the mid-1980's some birds were captured live and taken to the collection of J. Estudillo in Mexico, where they are now breeding successfully. Recently, in 1992, a bird was seen in the Cerros de Távara, southern Peru, about half way between the two known populations, although it is not known which race was involved. This underlines how little is known regarding the species' range and offers reasonable hope of the existence of further populations as yet undiscovered. Expeditions are urgently needed to search for unknown populations, particularly in the foothills of the Andes and outlying ridges in the frontier area between Peru and Bolivia; also, reserves should be declared in all areas known to hold populations.

Five species of cracids are currently classified as Endangered, although in the ICBP/IUCN Red Data Book further distinctions are drawn: the cases of the Trinidad Piping-guan and the Northern Helmeted Curassow are considered "serious", whilst those of the White-winged Guan, and the Alagoas and Blue-billed Curassows are "critical". This last species is noteworthy because no wild populations are known; the urgent action required for all Endangered species, in order to avoid rapid extinction, can, in this case, only be put into action once a population is found.

The Trinidad Piping-guan has one of the smallest populations of any cracid, estimated in 1980 at about 100 birds, in

two well separated populations, in the Northern and Southern Ranges of the island of Trinidad. Once again, the combination of habitat destruction and illegal hunting has been responsible for the dramatic decline of the species, which was widespread and abundant in the second half of the nineteenth century and still maintained large numbers during the 1940's. Despite this slump, no conservation measures were taken until very recently, due partly to the fact that this form has traditionally been considered a race of the closely related Blue-throated Piping-guan. Its recent recognition as a separate species, although not accepted unanimously (see Systematics), has made it Trinidad's only endemic bird species and appears to have stimulated interest in its conservation. In the 1980's the government organized various environmental education campaigns, including a television advert, which have raised the popularity of the bird on the island. However, urgent measures are still required: the species has been legally protected since 1963, and the laws



must be put into practice, as must those against squatting and logging which still continue in the areas it inhabits, although nearly all of them are in forest reserves or state forests. A system of national parks including the key areas for the species has been on the agenda for some time, but has still to be put into action.

The situation of the Northern Helmeted Curassow is similar to that of other threatened cracids. Deforestation and persecution, not only for food but also for the helmet which is used by Indians to make necklaces, have made it rare to very rare in most of the areas for which there are data, mainly the mountains of north Venezuela. This indicates a sharp decline, as in parts of this region the species was reported to be common in the nineteenth century and still fairly common in the 1950's, although it probably lives naturally at fairly low densities. Although reliable information is not available, it is feared that the species is also under pressure in the Andes, both in Venezuela and Colombia, and in the Sierra de Perijá, where a separate subspecies occurs.

The Blue-billed Curassow is without doubt one of the most critically threatened cracids. The last sighting of a bird in the wild was in 1978, at Puerto Berrío in Antioquia, Colombia. However, the recent illegal importation into Japan of four birds apparently captured in the wild in Colombia raises hopes that a small population survives, although if this so, it is still clearly being exploited for trade. The reasons for the critical status of this species, compared to that of congeners with similar ecological needs, are centred on its restricted range in the lowlands and foothills of north Colombia, and the fact that this is an area where deforestation has been particularly severe, and hunting pressure equally heavy. This is the only Endangered cracid for which no conservation measures have yet been taken; some birds have been bred in a few collections, but as yet there is no captive breeding programme on which a recovery plan might be based. Even more urgently needed is a survey of any sizeable remnants of forest in its range, with a view to establishing its current status and setting up suitable reserves.

One of the most remarkable cases is that of the White-winged Guan. The species was described in 1877 by L. Taczanowski from a male collected in the previous year on a mangrove covered island in the delta of the River Tumbes, in

north-western Peru. The species was already thought to be on the point of extinction due to continual persecution, although the locals explained that it had been common only 30 years before. In the same year, 1877, a female was shot and a chick taken and hand-reared. These two birds, together with the type specimen, were the only museum skins in existence for many years. Nothing further was known of the species, despite specific searches by M. and H. W. Koepcke in the 1950's. This complete lack of information led to the questioning of its taxonomic validity (see Systematics).

In 1977, after the species had been thought extinct for a century, G. del Solar and J. P. O'Neill visited the Andean foothills in Lambayeque Department, going to a small agricultural plot owned by a local farmer who had assured them that guans with white wings lived in the area. Accompanied by the farmer, at an altitude of about 600 m, they sighted the first White-winged Guan to be seen by biologists in 100 years. By the end of the day they had recorded six to eight birds. The rediscovery had taken place in dry forest, quite a distance from the coast, despite the fact that all the old records were from coastal areas with mangroves. A year later, E. Ortiz began a detailed study of the feeding and habitat requirements of the species, its population and its chances for continued survival, with the result that the species became better known than many other guans with much larger populations and more extensive ranges. It is currently estimated to have a population of a few hundred birds, which, lamentably, still suffer from habitat loss and hunting pressure. An environmental education campaign is urgently required so that the local population can develop an interest in the conservation of this species, which is not found anywhere else in the world. The survival of the species also depends on the efficient implementation of the legal measures passed in 1980 to protect the habitat and ban hunting, which have so far proved purely nominal. On the positive side, a captive breeding programme has been started in the area, with remarkable success, no less than four pairs breeding.

Despite the precarious status of many of the species already discussed, no cracid is in a more desperate situation than the Alagoas Curassow. A detailed description of this bird, including an unmistakable illustration, appeared as far back as 1648 in the German naturalist G. Marcgraf's *Historia Naturalis Brasili-*



At present, the Red-billed Curassow is the only cracid that is the object of a documented reintroduction programme; this is being carried out in a reserve near Ipatinga, in Minas Gerais. This species, endemic to the heavily ravaged Atlantic forests of Brazil, is certainly in an alarming state in the wild, with only a few hundred individuals remaining, scattered among six or seven forest patches. The reintroduction programme is based on a large captive population kept at the Fundação Crax, in Minas Gerais, where several dozen pairs breed each year.

[*Crax blumenbachii*.
Photo: Luiz Claudio
Marigo/Bruce Coleman]

This historic photograph shows some of the founder members of the only existing captive population of the Alagoas Curassow, which resides in the collection of P. M. Nardelli, near Rio de Janeiro. This is the only cracid species considered to be extinct in the wild, so its future depends entirely on this population, which in 1993 consisted of 34 birds, most of which were hatched in captivity. The photograph clearly illustrates the main characteristics which distinguish this species from the Razor-billed Curassow (*Mitu tuberosa*), with which it was traditionally considered to be conspecific: these are the bare patch of skin around the ears; the two-tone colouring of the bill; and the pale brown, rather than pure white, tail tips.

[*Mitu mitu*.

Photo: Pedro Nardelli]



liae, a work that would be used by Linnaeus as the foundation for the description of those Brazilian species included in his *Systema Naturae*. However, the total lack of data ever since, and the lack of even a single specimen (see Systematics), led to ever-increasing doubt about the existence of this species; it was even thought that Marcgraf's description might have been based on a Razor-billed Curassow imported from the Amazon.

In 1951, however, on a tour of Alagoas, the Brazilian ornithologist O. Pinto found the corpse of a curassow that had been killed in the area. Comparisons with skins of Razor-billed Curassows showed various differences, demonstrating that the old description by Marcgraf was precise and correct. The species was assumed to be very rare, due to the extreme destruction of the habitat and the intense hunting pressure, and by 1970 some workers considered it to be definitely extinct, while others estimated its total population at less than 20 birds. In 1978 and 1979, in remnants of forest that were being converted into sugar cane plantations for a distillery, five birds were captured by the Brazilian aviculturist P. M. Nardelli. These were the founders of the captive population kept in the Zôo-Botânica Mário Nardelli, near Rio de Janeiro, the subject of various studies (see Systematics). The birds have bred fairly well, both naturally and with artificial insemination, 37 young having been reared. In 1993 the population stood at 34 birds.

As regards the wild population, the last reference corresponds to a bird seen in 1987, and killed shortly afterwards, so it is now believed extinct in the wild, or, at most, that a few individuals survive with no viable future. Appropriate management of the captive stock, perhaps the entire world population of the species, is, therefore, of fundamental importance and would seem to call for the involvement of the appropriate Brazilian government institutions and international conservation bodies. In any event, the short-term possibilities of implementing a programme of reintroduction are remote, as in 1992 it

was calculated that only 800 ha of lowland forest remained in Alagoas, with an estimated capacity of some 32 pairs; even at this stage the area is still totally unprotected.

All these cases indicate that both research and conservation measures must urgently be stepped up for the cracids, not just for the ethical or aesthetic benefits of conserving these interesting birds, but also for much more pragmatic reasons. Cracids are important both as a source of protein for local human populations and as seed dispersers of numerous plant species (see Food and Feeding), a vital function for the long-term maintenance of healthy forests. In addition, their very sensitivity to the two major forms of human intervention, habitat loss and hunting, and the fact that they are normally fairly easy birds to survey means that, together with the primates, they are amongst the most useful groups to use as indicators of habitat quality in Neotropical forests, and of the efficiency of various types of management programmes. Only the realization by governments that cracids are a valuable national resource, with important biological and ecological roles, can reverse the currently alarming trends of many of these species.

General Bibliography

- Allen *et al.* (1977), Amadon (1970, 1979), Bennett *et al.* (1982), Blake (1977), Brodkorb (1964), Davis (1965), Delacour & Amadon (1973), Dobson & Ortiz (1988), Escalante & Strahl (1993), Estudillo López (1979a, 1981), Frank *et al.* (1981), Haffer (1987), Krieg & Schuhman-cher (1936), Lovejoy & Brash (1984), McDonald (1993), Ollson (1976), O'Neill (1991), Ouse (1991), Prager & Wilson (1976), Raethel (1988), Ruschi & Amadon (1959), Rutgers & Norris (1970), Scheres (1990), Selater & Salvin (1870), Sibley & Ahlquist (1990), Sibley & Monroe (1990), Sibley *et al.* (1988), Sick (1985a, 1985b, 1993), Stock & Bunch (1982), Strahl (1988, 1990), Strahl & Grajal (1991), Strahl & Silva (1989), Sych & Bogdanovich (1988), Taibel (1965), Teixeira & Sick (1986), Throp (1964), Todd (1932), Vaurie (1968), Verheyen (1956), Vuilleumier (1965), Wagner (1960).

ssp. venusta

ssp. mecallii

1

2

3

inches

12

cm

30

PLATE 30

ssp. ruficrissa

4

ssp. ruficauda

5

ssp. pantanalensis

ssp. canicollis

8

6

7

ssp. columbiana

10

ssp. squamata

ssp. subaffinis

9

ssp. araucuan

10

ssp. guttata

11

12



Subfamily PENELOPINAE

Genus *ORTALIS* Merrem, 1786

1. Plain Chachalaca

Ortalis vetula

French: Ortalide chacamel **German:** Blauflügelguan **Spanish:** Chachalaca Norteña
Other common names: Common/Mexican/Eastern Chachalaca; Northern Chachalaca (*mccallii*); Utila Chachalaca (*deschauensei*)

Taxonomy. *Penelope vetula* Wagler, 1830, Mexico.

O. poliocephala and *O. leucogastra* formerly considered races of present species. Population of dry interior valley of Chiapas, S Mexico, was separated in race *vallicola*, but differences slight and not usually recognized. Isolated population in Costa Rica may represent undescribed race; sometimes assigned to *O. leucogastra*. In Chiapas, range meets, and may slightly overlap with those of *O. poliocephala* and *O. leucogastra* but hybridization not recorded. Four subspecies currently recognized.

Subspecies and Distribution.

O. v. mccallii Baird, 1858 - extreme S Texas (USA) and NE Mexico S to N Veracruz.
O. v. vetula (Wagler, 1830) - E & S Mexico, Belize, E Guatemala, Honduras, W Nicaragua and NW Costa Rica.
O. v. pallidiventris Ridgway, 1887 - N Yucatán.
O. v. deschauensei Bond, 1936 - Utila I, off N Honduras.



Descriptive notes. 48-58 cm; male 468-794 g, female 439-709 g. Plain coloration. Juvenile more olivaceous above. Races vary in size and coloration; nominate darker and more richly coloured than all other races; very dark variants of nominate race occasionally occur in S Mexico and Central America.

Habitat. Areas of tall brush vegetation, thickets, scrub and second growth in lowlands. In S Veracruz ventures along streamside tangles into rain forest, but in areas where meets or approaches range of *O. poliocephala* and *O. cinereiceps*, present species found in drier habitats. In Guatemala and Honduras, also occurs in lowland and pre-montane forest, from sea-level locally up to c. 1850 m. Race *deschauensei* found in mangroves covering three quarters of Utila I; also, formerly, in adjacent scrub patches.

Food and Feeding. Fruits of many kinds, including hackberries (*Celtis laevigata*, *C. pallida*), mesquite (*Prosopis glandulosa*), mangoes, palmettos, persimmons, wild grapes, figs, *Bumelia*, *Achros*, *Juniperus flacida*; fleshy fruit apparently makes up roughly half of diet. Also fresh green leaves, shoots, buds and twigs of several trees. Occasionally takes some insects from ground. Forages in groups of up to 15 birds.

Breeding. Mar-May in Yucatán and S Chiapas, Apr-May in Texas, Jul in Tamaulipas and Nuevo Leon. Nest is small, flimsy structure of plucked sticks, grasses and leaves, lined with a few green leaves, placed in dense vegetation (trees or bushes), usually at 1.5-7 (0.9-10) m above ground; of 209 nests examined in Texas, 204 (98%) were in trees and 5 (2%) in vines supported by trees; occasionally, no nest structure is used at all, with eggs laid on stubs, bare crotches or horizontal portions of limbs. Lays 3 eggs (2-4); incubation 22-27 days, most often 25; chicks are cinnamon buff, russet and black above, white below, with cinnamon buff band across breast. Apparently, some birds breed at 1 year old, others at 2. In Texas, overall success from 455 incubated eggs was 50%, with average of 2.5 chicks per successful nest.

Movements. Sedentary.

Status and Conservation. Not globally threatened. Still common in much of range, and locally very common. Favoured by shifting agriculture practices, permitting fields to lie unplanted and become covered with thickets and light woods. In contrast, unable to tolerate intensive land use and mechanization of agriculture; in lower Rio Grande Valley, Texas, clearing for agriculture has eliminated species, except in a few protected areas; species is currently object of transplantation programme in several parts of S Texas; greatest density in USA in Santa Ana National Wildlife Refuge, with an average of 2-77 birds seen per hour of census effort. On Caribbean slope of Guatemala, is last cracid to disappear in face of human pressure. In Costa Rica, common in higher mountains of Nicoya Peninsula; scarce and local in NW Pacific lowlands. Heavily hunted throughout most of range. Race *deschauensei* local but not rare in 1936, but has declined severely since, due to intense hunting pressure; in 1962 total population of this race estimated at 50-70 birds; recently reckoned possibly extinct. Introduction of birds of race *mccallii* to Sapelo I, off Georgia, USA, in 1923 was initially successful, but population declined during 1960's, and no birds recorded since 1966. Quite common in captivity, where frequently bred. CITES III in Guatemala and Honduras.

Bibliography. Aldrich & Duvall (1955), Alvarez del Toro (1981b), Balda (1989), Bent (1932), Bond (1936), Brodkorb (1942), Christensen (1978), Davis (1965), Fleetwood & Bolen (1965), Griscom (1932), Johnsgard (1975), King (1978/79), Land (1970), Leopold (1959), Lever (1987), Lowery & Dalquest (1951), Marion (1974, 1976, 1977), Marion & Fleetwood (1978), Mayr & Short (1970), Miller & Griscom (1921a, 1921b), Mondragón & Baez (1981), Monroe (1968, 1970), Moore & Medina (1957), Ridgely & Gwynne (1989), Ridgway & Friedmann (1946), Root (1988), Rutgers & Norris (1970), Saunders (1950), Slud (1964), Smith (1966), Stiles & Skutch (1989), Taibel (1955), Terres (1980), Vannini & Rocksroh (1988), Vaurie (1965a), Wetmore (1943), Zepeda (1981).

2. Grey-headed Chachalaca

Ortalis cinereiceps

French: Ortalide à tête grise **German:** Graukopfguan **Spanish:** Chachalaca Cabecigrís

Taxonomy. *Ortalis cinereiceps* G. R. Gray, 1867, "north-west coast of America," error = Pearl Islands (?).

Forms superspecies with *O. garrula*, of which has been considered a race, but differs in voice and plumage, and, despite claims of sporadic hybridization in wild, they are separated by stretch of dense forest probably unsuitable for any *Ortalis* (see page 312). Several races (*frantzii*, *mira*, *olivacea*, *chocoensis*) proposed on basis of colour tone; but differences slight and essentially clinal. Monotypic.

Distribution. E Honduras, E & C Nicaragua, Costa Rica (except drier NW), Panama (including Isla del Rey in Pearl Is, where perhaps introduced by Indians) and adjacent NW Colombia.



Descriptive notes. 46-58 cm; 490-540 g, but one bird 682 g. Bright chestnut primaries conspicuous in flight. Juvenile browner, especially on head.

Habitat. Tangled thickets, light second growth woods, plantations, bushy abandoned fields, clearings and thinned out forests, in humid areas; lowlands or hills, locally up to 1700 m. Especially favours thickets where scattered, rapidly growing trees rise well above shrubs and vines. Shuns dense forest, although can occur in open borders of streams or sometimes in forest canopy, taking fruit from tree tops.

Food and Feeding. Fruits, e.g. spikes of guamo trees (*Cecropia*), berries (*Hamelia patens*, *Miconia hyperprasinia*, *Mantlingia calabura*, *Phytolacca*), drupes of acituno (*Simaruba glauca*) and guavas (*Psidium guajava*); guava fruits taken from branches of trees, not from ground. Also leaves, whole or pieces pecked off plant, e.g. of composite shrubs (*Veronia patens*, *Oyedaea verbesinoides*); occasionally insects. Has been recorded picking up food in rivers, and from branches over water or exposed rocks; during dry season, also visits rivers to drink, in morning and evening. Forages in groups of 6-12 or even more birds, at all vegetation strata; mainly arboreal, but does come to ground, where sometimes scratches to uncover food.

Breeding. Season variable, with laying recorded Jan-May, comprising at least part of rainy season. Nest is broad, shallow platform of sticks, leaves, grass stems, pieces of vine and inflorescences, placed in vine-draped bushes, tangles of creepers or small trees, at 0.9-2.4 m above ground. Usually 3 eggs (clutches of 2 may be incomplete); incubation over 22 days; chicks dull chocolate brown and sooty brown above, with some cinnamon marks, cinnamon and white below.

Movements. Presumably sedentary.

Status and Conservation. Not globally threatened. In Costa Rica often common where not severely hunted. Fairly common in many areas of Panama, although has declined locally, e.g. on Isla del Rey (Pearl Is), and parts of Darién, where much hunted by Indians; well protected in Barro Colorado I Biological Reserve and quite numerous in wooded areas of Canal zone. Common in Colombia in 1986. Hunted for food throughout most of range. Adapts well to moderate habitat alterations, although has been extirpated from some areas by combination of deforestation and heavy hunting pressure. Birds from Panama introduced to Hawaiian Is in 1928, but died out. Uncommon in collections, but has bred. **Bibliography.** Haffer (1967), Hernández & Rodríguez (1988), Hilly & Brown (1986), Ridgely & Gwynne (1989), Ridgway & Friedmann (1946), Slud (1964), Skutch (1963, 1983a), Stiles & Skutch (1989), Vaurie (1965c), Wetmore (1965), Willis (1980).

3. Chestnut-winged Chachalaca

Ortalis garrula

French: Ortalide babillarde **German:** Rotflügelguan **Spanish:** Chachalaca Alirroja

Taxonomy. *Phasianus garrulus* Humboldt, 1805, Magdalena River, Colombia.

Forms superspecies with *O. cinereiceps*, which has been considered race of present species; they differ in voice and plumage, and, despite statements about sporadic hybridization in wild, they are separated by an area of dense forest probably unsuitable to any *Ortalis* (see page 312). Probably meets *O. ruficauda* in E of range (Guajira), but no evidence of hybridization. Monotypic.

Distribution. NW Colombia.



Descriptive notes. c. 53 cm; 630-755 g. Bright chestnut primaries conspicuous in flight.

Habitat. Dense tropical thickets, scrubby deciduous forest, tall second growth, and scrub, riparian woodland and mangroves of N coastal region. Lowlands up to c. 800 m. Avoids densely forested areas, but occurs in humid forest borders at N base of Andes.

Food and Feeding. Forages in groups of up to 12 birds.

Breeding. Apr. One nest built by male in captivity. Usually 3 eggs; incubation c. 26 days; chicks are brown and reddish brown above, buff and whitish below.

Movements. No information available; presumably sedentary.

Status and Conservation. Not globally threatened. Considered common in 1986, and probably remains so at present in much of range. Uncommon in collections, but has been bred.

Bibliography. Haffer (1967, 1975), Hernández & Rodríguez (1988), Hilly & Brown (1986), Mannkelle (1970), Mayr & Short (1970), Monroe (1968), Ridgway & Friedmann (1946), Taibel (1953), Vaurie (1965c).

4. Rufous-vented Chachalaca

Ortalis ruficauda

French: Ortalide à ventre roux **German:** Rotschwanzguan **Spanish:** Chachalaca Culirroja
Other common names: Rufous-tailed/Red-tailed Chachalaca; Rufous-tipped Chachalaca (*ruficauda*)

Taxonomy. *Ortalis ruficauda* Jardine, 1847, Tobago.

Race *ruficrista* has been considered separate species, but intergradation with *ruficauda* occurs N of Cúcuta, in N Colombia, and in hinterland of L Maracaibo, Venezuela; birds of latter area have been awarded different race, *balios* (see page 312). Population of Serranía de Macuira in Guajira Peninsula, NE Colombia, has also been separated in different race, *lampophonis*; validity doubtful, but deserves further study. Probably meets *O. garrula* in W of range (Guajira), but no evidence of hybridization. Two subspecies recognized.

Subspecies and Distribution.

O. r. ruficrista P. L. Selater & Salvin, 1870 - N Colombia and NW Venezuela.
O. r. ruficauda Jardine, 1847 - NE Colombia, N & NE Venezuela (including Margarita I) and Tobago; also Bequia I and Union I, Lesser Antilles, where probably introduced from Tobago.

Descriptive notes. 53-61 cm; 430-800 g. Greyish buff belly becomes rufous on undertail-coverts. Immature resembles adult. Races differ in size, tone of general coloration and colour of tail tip.



Habitat. Thorny deciduous brushland and forest in fairly open areas, e.g. *llanos* of Venezuela and Colombia; often near water, in gallery forest, along rivers or near lagoons. Marked preference for abandoned farmland, with mixed second growth and palms. Also clearings, in areas of humid forest. Mainly in lowlands; locally up to 1600 m in Venezuela. **Food and Feeding.** Fruits, tender shoots and leaves. Main food types are fruits, and occasionally leaves, of tree *Genipa caruto*, and nut-like fruits of palm *Copernicia tectorum*. Also leaves and flowers of guarumo (*Cecropia*). Forages in flocks of 4-20 birds, occasionally

over 50; usually in trees, sometimes on ground.

Breeding. Eggs in Jul in Colombia; all year round in Tobago, with peak Mar-Jun. Nests, made of twigs and leaves, have been found built in trees, usually 1-3 m above ground, occasionally as high as 20 m; only *Ortalis* definitely known to nest on ground sometimes, at edge of grassy glades. Lays 3-4 eggs, occasionally 2; incubation c. 28 days. One juvenile weighing only 300 g seen to fly as well as an adult.

Movements. No information available; presumably sedentary.

Status and Conservation. Not globally threatened. Common in Colombia. Secure in Tobago, where scrub habitat ideal for species; an increase in numbers was observed when many farms abandoned after a hurricane in 1963. Uncommon in collections, but has been bred.

Bibliography. Bond (1979), French (1973, 1992), Friedmann & Smith (1950, 1955), Herklots (1961), Hernández & Rodríguez (1988), Hilly & Brown (1986), James & Hislop (1988), Lapham (1970), Lever (1987), Mayr & Short (1970), Meyer de Schauensee & Phelps (1978), Ocampo (1981), Porras & Arriaga (1981), Ridgway & Friedmann (1946), Schmutz (1991), Snow (1985), Strahl & Silva (1988), Vaurie (1965c).

5. Rufous-headed Chachalaca

Ortalis erythroptera

French: Ortalide à tête rousse German: Rotkopfguan Spanish: Chachalaca Cabecirrufo
Other common names: Ecuadorian Chachalaca

Taxonomy. *Ortalis erythroptera* P. L. Sclater and Salvin, 1870, Babahoyo and Guayaquil, western Ecuador. Monotypic.

Distribution. W Ecuador and extreme NW Peru; may occur in SW Colombia (Nariño).



Descriptive notes. 56-66 cm; 620-645 g. Similar to *O. garrula*, but tail tips rufous and lower breast and abdomen more creamy.

Habitat. Dry deciduous forest, humid cloud forest, thickets, savanna and brushy areas, occasionally on agricultural land, in tropical coastal zone, inland to Andean foothills. In Sozoranga Mts, Loja (S Ecuador), occurs in dry *Ceiba* dominated deciduous forest, but is commoner in semi-evergreen and evergreen forest patches. Previously observed up to 1390 m, but recently seen at 1850 m, and heard apparently not much below 2500 m. Not found in arid regions.

Food and Feeding. Birds have been observed pecking leaves of cloud forest trees, and one bird had leaves in its stomach. A flock frequented a banana plantation; one bird seen on ground in a maize field. Forages mainly in small groups of 2-7 birds.

Breeding. In Peru silent, and probably not breeding, during dry season (Jun-Jul). Lays 3 eggs (in captivity); incubation 26-28 days (in captivity); chicks unevenly rust brown, chestnut brown to dark brown and black above, paler below.

Movements. No information available, but presumably sedentary.

Status and Conservation. Not globally threatened. Currently considered near-threatened. Has suffered range contraction which appears to be closely linked with habitat destruction, through logging, overgrazing and agricultural intensification. Uncommon to rare in all localities where known to occur in Peru, including some where forest is in good condition. More widely distributed in W Ecuador, but major decline also reported here; only 3% of Ecuador's lowland forest estimated to remain in 1991, when surviving patches were being further exploited and degraded. Previously unknown population found in 1989 in Sozoranga Mts, Loja; birds found in small patches (up to 30 ha) of remaining pre-montane forest, which has mostly been severely altered, and substituted by tall second growth and dense scrub; species also found on lower slopes, where much more extensive forest legally protected below 1000 m. In 1991 an international expedition (Ecuadorian Dry Forest Project) located c. 30 groups, totalling c. 100 birds at 7 localities in Loja and El Oro; maximum density of 6 calling groups in area of 1-2 km² recorded in Sozoranga area, where species fairly common in many forest remnants; some birds seen in degraded areas and on agricultural land, but habitat requirements poorly understood. Also suffers hunting pressure, though less than other, larger cracids; in Sozoranga, birds seen in forests adjacent to roads and near villages; relative unpalatability of adults may limit hunting to shortly after breeding season when tender juveniles present. Thought to be hunted by soldiers posted along border between Ecuador and Peru. Another probable threat is genetic isolation of groups in forest remnants. Occurs in several protected areas, including Machabilla National Park in Ecuador and Tumbes National Forest in Peru, although both subject to disturbance. Project under way in Ecuador to assess status and adaptability to secondary forest; efforts are being made to persuade government of Ecuador to buy a small, but important, patch of remaining forest in Sozoranga, which holds this and 6 threatened species of birds. Rare in captivity, but successfully bred in 1989 in Ornithological Zoo at Schmiding, Austria.

Bibliography. Arltmann (1990), Best (1992, 1993), Best & Clarke (1991), Best *et al.* (1993), Clarke (1990), Collar & Andrew (1988), Ortiz, E. & O'Neill (1988), Ortiz, E. (1981), Parker *et al.* (1982), Wiedenfeld *et al.* (1985).

6. Rufous-bellied Chachalaca

Ortalis wagleri

French: Ortalide à ventre marron German: Rotbrustguan Spanish: Chachalaca Ventricastada
Other common names: Wagler's Chachalaca

Taxonomy. *Ortalis wagleri* G. R. Gray, 1867, California and Mexico.

Forms superspecies with *O. poliocephala*, of which formerly considered a race; a few cases of hybridization in NW Jalisco were interpreted as proof of a narrow zone of intergradation in W Jalisco and W Colima, where intermediates were even considered a different race, *lajuelae*; cases of hy-

bridization may have resulted from escapes of imported *O. poliocephala* (see page 312). Population of Sonora was considered a different race, *griseiceps*, but not usually recognized. Monotypic.

Distribution. W Mexico, from S Sonora S to NW Jalisco.



Descriptive notes. 62-67 cm. Most richly coloured *Ortalis*. Bare skin around eye pink and blue. Juvenile duller, lacks well defined chestnut tail tips.

Habitat. Tropical deciduous forest and thorn forest in lowlands. Also sometimes in palm plantations and dense mangroves along coast. Present in areas with drier vegetation than *O. poliocephala*, and at lower altitudes, seldom above 1300 m.

Food and Feeding. Fruits of trees.

Breeding. Peak of nesting period apparently Jun in S Sinaloa, with laying also in May and Jul. One nest was 1 m above ground in a small spiny tree c. 3-5 m tall. Usually 3 eggs; chicks are variegated rich brown and buffy white, paler below.

Movements. No information available, but presumably sedentary.

Status and Conservation. Not globally threatened. Occurs in a variety of habitats, including some severely altered by man, and therefore not considered of immediate conservation concern.

Bibliography. Banks (1990), Davis (1965), Mayr & Short (1970), Moore & Medina (1957), Ridgway & Friedmann (1946), van Rossem (1934a, 1942), Schaldach (1963), Vaurie (1965a).

7. West Mexican Chachalaca

Ortalis poliocephala

French: Ortalide de Wagler German: Graubrustguan Spanish: Chachalaca Pechigris

Taxonomy. *Penelope poliocephala* Wagler, 1830, Mexico.

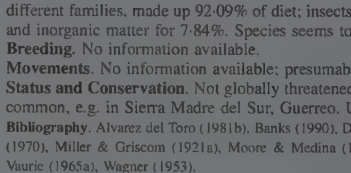
Forms superspecies with *O. wagleri*, which was formerly considered a race of present species; a few cases of hybridization in NW Jalisco were interpreted as evidence of a narrow zone of intergradation in W Jalisco and W Colima, where intermediates were even considered a different subspecies, *lajuelae*; cases of hybridization may have resulted from escapes of imported birds of present species (see page 312). Formerly considered a race of *O. vetula*. In S, range meets those of *O. leucogastra* and *O. vetula*, perhaps with slight overlap; no cases of hybridization known. Monotypic.

Distribution. W Mexico, from S & NE Jalisco and Colima S to CS Chiapas.

Descriptive notes. 62-67 cm; c. 760 g. One of largest *Ortalis*. Tail tips pale buff.

Habitat. Mainly tropical deciduous forests, with rather narrow humidity limits, as avoids rain and cloud forests and does not occur in dry oak-pine forests, except in most humid gullies with luxuriant vegetation. Also sometimes in palm plantations and dense mangroves. In the 2 narrow areas of contact with *O. wagleri* and *O. vetula*, present species found in wetter woodland, reaching higher altitudes, up to 3000 m.

Food and Feeding. Diet based on plant matter, represented by leaves, seeds, flowers and fruits. In one study in Jalisco, plant matter, from 15



different families, made up 92.09% of diet; insects of 3 different families accounted for only 0.006% and inorganic matter for 7.84%. Species seems to be important disperser of seeds.

Breeding. No information available.

Movements. No information available; presumably sedentary.

Status and Conservation. Not globally threatened. Still common in much of range, and locally very common, e.g. in Sierra Madre del Sur, Guerrero. Uncommon in collections, but has been bred.

Bibliography. Alvarez del Toro (1981b), Banks (1990), Davis (1965), Gurrola Hidalgo (1981, 1985), Mayr & Short (1970), Miller & Griscom (1921a), Moore & Medina (1957), Ridgway & Friedmann (1946), Schaldach (1963), Vaurie (1965a), Wagner (1953).

8. Chaco Chachalaca

Ortalis canicollis

French: Ortalide du chaco German: Chacoguan Spanish: Chachalaca Charata
Other common names: Grey-headed Chachalaca (!)

Taxonomy. *Penelope canicollis* Wagler, 1830, Paraguay.

Has hybridized in captivity with *Pipile caninus*. Birds of Paraguayan Chaco have been separated in different race, *ungeri*, but validity doubtful. Two subspecies recognized.

Subspecies and Distribution.

O. c. canicollis (Wagler, 1830) - Chaco in E Bolivia, W Paraguay and N Argentina.

O. c. pantanalensis Cherrie & Reichenberger, 1921 - SW Mato Grosso, Brazil.



Descriptive notes. 50-56 cm; 479-599 g. Head and neck contrast little with colour of back and breast. Immature resembles adult. Race *pantanalensis* browner, less greyish, and larger.

Habitat. Swampy lowland forest and surrounding *mimosa* scrub; frequents borders of trails and edges of groves with dense, close cover. Nominant race also in dry subtropical forest of Andean foothills in Argentina, up to c. 1000 m. Race *pantanalensis* also in semi-deciduous forest, gallery forest, *cerrado* woodland, secondary forest and palm groves, in one study in N Argentina, more abundant in secondary than in pristine woodlands.

Food and Feeding. Leaves, fruits, seeds and flowers; also caterpillars, which can be important in periods of abundance. In one study in N Argentina, herb leaves made up 36.6% of dry mass, fleshy fruits 24.9%, caterpillars 22.1% and flowers and seeds 6.6%. Most popular fruits were those of molle (*Schinus molle*); others included those of mistol (*Zizyphus mistol*), sangre de toro (*Rivina humilis*), coro (*Jodina rhombifolia*), tala (*Celtis pallida*) and tala blanca (*Achatocarpus praecox*). Of flowers, most important were those of garabato (*Acacia*); elsewhere, flowers of *Tabebuia* trees also recorded. All caterpillars were of same species, the mistol butterfly, which abounds in the area in certain years. Leaves and fruits were consumed all year round, with proportion of latter increasing

significantly during wet season. Seeds of fruits are defecated intact, suggesting species is a disperser; apparently, *Schinus polygamus* and *Jodina rhombifolia*, with fruit which ripens in winter, depend on present species for seed dispersion during dry season. Species forages mostly in groups of up to 30 birds, generally in crowns of trees; sometimes on or near ground, especially where undergrowth not too dense.

Breeding. Nov-Feb in N Argentina, during rainy season. Nest is small, simple, shallow platform, loosely built with sticks, stems, tendrils and leaves, without lining; usually situated 2.5-4 m up in dense bush or tree. Lays 3-4 eggs.

Movements. Presumably sedentary.

Status and Conservation. Not globally threatened. In Brazil, common in all regions of Pantanal, and in less frequented portions of Chaco; probably also in Paraguay. Still common and locally abundant in Argentina, although extensive sections of potential habitat in Chaco have been degraded by overgrazing, wood extraction and fires, resulting in range contraction in several areas, e.g. Tucumán; abundant in El Rey National Park (44,000 ha), NW Argentina, but limited to Chaco habitat and also around buildings of park headquarters; also very common in Pilcomayo National Park (60,000 ha), Formosa. S limit of range in Argentina has shown slight retraction: formerly present S at least to Capilla del Monte, NC Córdoba, but now occurs only in extreme N of province. Relatively common in Bolivian Chaco adjacent to border with Argentina. Persecuted by hunters for food and sport; one hunter recently killed 40 birds in one day in Salta; hunting of species permitted seasonally in Formosa and Tucumán, Argentina. In Bolivia, has no legal protection and is hunted year round, not only by local people but also by hunters coming in organized safaris from Argentina. Commonly kept in captivity locally and in some collections abroad, where is regularly bred.

Bibliography. Bucher (1980), Canevari & Cazzani (1988), Cazzani & Protomastro (1988, 1994), Contino (1980), Dubs (1992), Kerr (1950), Nöres & Yaurieta (1988), Nöres *et al.* (1983), de la Peña (1979, 1992), Pinto (1964), Remsen & Traylor (1989), Sick (1985a, 1993), Vaurie (1964), Wetmore (1926).

9. White-bellied Chachalaca

Ortalis leucogastra

French: Ortalide à ventre blanc **German:** Weibachguan **Spanish:** Chachalaca Ventriblanca

Taxonomy. *Penelope leucogastra* Gould, 1843, no locality.

Formerly considered subspecies of *O. vetula*. Isolated population of *O. vetula* in Costa Rica sometimes assigned to present species. Probably forms superspecies with *O. guttata*, *O. motmot* and *O. supercilialis*. In N, range meets those of *O. poliocephala* and *O. vetula*, perhaps with slight overlap; no cases of hybridization known. Monotypic.

Distribution. Extreme SW Mexico (SE Chiapas), S Guatemala, El Salvador, S Honduras, NW Nicaragua and NW Costa Rica.



Descriptive notes. 43-50 cm; 439-560 g. Brown breast rather abruptly separated from dull white belly. Juvenile like adult, but plumage looser and fluffier.

Habitat. Swampy forest, swamps with coyal palm undergrowth and thick, second growth scrub; also dry forests, pasture or plantation edges and mangrove forests, in lower tropical zone of Pacific slope. Commonest on coastal plain, but also occurs in hills up to c. 1500 m.

Food and Feeding. Mainly berries and fruits, either green or ripe, especially coyal palm dates; also leaves, buds, flowers and some invertebrates. Forages in groups of 6 or more birds,

usually at 6-10 m above ground; seems to come to ground less often than other species of *Ortalis*.

Breeding. Season rather protracted, with records of eggs from Mar to Jul in Guatemala; laying recorded in Apr and May in El Salvador. One record of communal nesting in plantation in Quetzaltenango, Guatemala, with at least 3 nests in adjacent trees. Nest is small, loosely built platform, lined with flattened leaves; placed in tree usually 5-10 m above ground, 2-3 eggs.

Movements. No information available, but presumably sedentary.

Status and Conservation. Not globally threatened. Still common to locally abundant in much of range; often seen near villages. Has lost habitat through conversion to pastures, sugar cane and cotton fields, but benefited from other alterations implying opening of dense forests; in Guatemala seems to be shifting its altitudinal range higher, as shaded coffee plantations with more open canopy apparently more suitable for species than original broad-leaved forests of lower Pacific slopes. Uncommon in Honduras and N Nicaragua. Uncommon in collections, but has been bred.

Bibliography. Alvarez del Toro (1981b), Dickerman (1987a), Dickey & van Rossem (1938), González (1986), Griscom (1932), Land (1970), Mayr & Short (1970), Miller & Griscom (1921a), Monroe (1968), Moore & Medina (1957), Ridgely & Gwynne (1989), Ridgway & Friedmann (1946), Saunders (1950), Vannini & Rockstroh (1988), Vaurie (1965a), Zepeda (1981).

10. Speckled Chachalaca

Ortalis guttata

French: Ortalide mailée **German:** Tüpfelguan **Spanish:** Chachalaca Moteada

Other common names: Spotted Chachalaca; Colombian Chachalaca (*columbiana*); Brazilian/White-bellied Chachalaca (*araucaum*); Scaled Chachalaca (*squamata*)

Taxonomy. *Penelope guttata* Spix, 1825, Rio Solimes, Brazil.

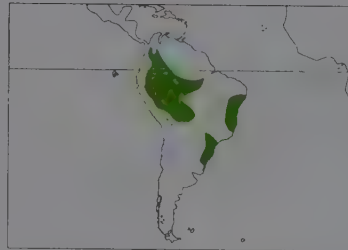
Forms superspecies with *O. motmot* and *O. supercilialis*, and probably also with *O. leucogastra*. Has been considered conspecific with first two, forming rather dissimilar and geographically disjunct Variable Chachalaca (*O. motmot*). Races *araucaum*, *squamata*, *columbiana* and *guttata* (incorporating *subaffinis*) may merit treatment as four separate species (see page 312). Population of N Colombia has been awarded race *caucaie*, but probably synonymous with *columbiana*; birds of SE Mato Grosso have been ascribed race *remota*, but apparently very similar or identical to *squamata*. Five subspecies usually recognized.

Subspecies and Distribution.

- O. g. columbiana* Hellmayr, 1906 - N & C Colombia.
- O. g. guttata* (Spix, 1825) - E Colombia, E Ecuador, E Peru, N Bolivia and W Brazil.
- O. g. subaffinis* Todd, 1932 - E & NE Bolivia and adjacent Brazil.
- O. g. araucaum* (Spix, 1825) - E Brazil.
- O. g. squamata* Lesson, 1829 - SE Brazil.

Descriptive notes. 45-60 cm; 500-600 g (*columbiana*). Feathers of lower throat and breast conspicuously edged or tipped white or buffy white. Races vary in size, coloration and shape of breast markings.

Habitat. Thickets, grassy slopes, palm groves, interfaces of forest and second growth, and low forests; less often in canopy or at edges of tall forest. In lowlands and foothills of tropical and



subtropical zones, locally up to near transition area with temperate zone, at minimum 2275 m in Bolivia, but up to 2500 m in Colombia and 2700 m in Peru. Race *squamata* mainly occurs from sea-level to 800 m.

Food and Feeding. Virtually no information; often takes catkins of guarumo (*Cecropia*) trees. Usually forages in small flocks.

Breeding. Feb (*columbiana*); one male in breeding condition in Jun (*guttata*); birds in breeding condition in Oct and Nov (*squamata*). Incubation reportedly 21 days.

Movements. No information available, but presumably sedentary.

Status and Conservation. Not globally threatened. Common in many parts of range, even in densely populated areas; seems to tolerate human activity fairly well. Race *columbiana* extirpated from many parts of its former range; currently localized. Race *guttata* fairly common in Colombia and Brazil, and common in Peru, where is most abundant cracid; in Peru threatened only very locally by habitat destruction for agriculture, and by hunting. Race *subaffinis* recorded daily in small numbers during survey of Río Machariapo dry forest, La Paz, Bolivia, in 1993. Race *araucaum* fairly common in many parts of range, including several reserves and parks. Race *squamata* rather uncommon in Rio Grande do Sul, SE Brazil; population recently discovered on Ilha do Cardoso, São Paulo, although no previous records from this state. Uncommon in captivity, but has been bred.

Bibliography. Bege & Marterer (1991), Belton (1984), Dubs (1992), Eijlsdä & Knabbe (1990), Forrester (1993), Hernández & Rodríguez (1988), Hilly & Brown (1986), Koeppke & Koeppke (1963), Miller (1952), Ortiz, E. & O'Neill (1988), Ortiz, F. (1981), Parker *et al.* (1982), Pearman (1993a), Pinto (1964), Remsen & Traylor (1989), Sick (1985a, 1993), Teixeira & Antas (1981), Vaurie (1965b), Zimmer & Osgood (1930)

11. Little Chachalaca

Ortalis motmot

French: Ortalide motmot **German:** Motmotguan **Spanish:** Chachalaca Motmot

Other common names: Guiana Chachalaca; Rufous-headed Chachalaca (*ruficeps*)

Taxonomy. *Phasianus Motmot* Linnaeus, 1766, Brazil and Guiana = Cayenne.

Forms superspecies with *O. guttata* and *O. supercilialis*, and probably also with *O. leucogastra*. Both *O. guttata* and *O. supercilialis* have been included in present species (see page 313). Race *ruficeps* has recently been considered full species by some authors. Two subspecies recognized.

Subspecies and Distribution.

- O. m. motmot* (Linnaeus, 1766) - S Venezuela, the Guianas and N Brazil, N of R Amazon.
- O. m. ruficeps* (Wagler, 1830) - NC Brazil, S of R Amazon.



Descriptive notes. 43-54 cm; 385-620 g. Chestnut head like *O. garrula* and *O. erythropetra*, but brown, not chestnut, primaries. Race *ruficeps* smaller and darker.

Habitat. Patches of forest with dense undergrowth along rivers or in clearings in more extensive woodlands. Also thick tangled coastal brush and dense second growth. Avoids dense forest. Lowlands up to 1700 m. In French Guiana prefers interface between savanna and forest, and secondary forest near settled areas.

Food and Feeding. Mainly berries and fruits. Usually forages in pairs or small flocks, in trees or on the ground.

Breeding. Records of laying in May, Sept and Dec in Surinam; Nov-Dec, at beginning of rains, in French Guiana. Nest is fairly small cup, made of small roots, flattened leaves and sticks, and lined with leaves; one nest was built on fork of small shrub at c. 2 m above ground, another in a low tree; in French Guiana species said to place nest low in bushes or even on ground. 3 eggs. No further information available.

Movements. No information available; presumably sedentary.

Status and Conservation. Not globally threatened. Considered rather common in Surinam, Guyana and French Guiana; in Brazil fairly common in Amapá, N Roraima, around Santarém (Pará) and around Manaus (Amazonas). Quite common in captivity, where frequently bred.

Bibliography. Forrester (1993), Haverschmidt (1956, 1968), Meyer de Schauensee & Phelps (1978), Pinto (1964), Porras & Arrigaia (1981), Sick (1985a, 1993), Snyder (1966), Strahl & Silva (1988), Teixeira & Antas (1981), Tostian *et al.* (1992), Vaurie (1965b)

12. Buff-browed Chachalaca

Ortalis supercilialis

French: Ortalide à sourcils **German:** Gelbbraueguan **Spanish:** Chachalaca Cejuda

Other common names: Superciliated Chachalaca

Taxonomy. *Ortalis supercilialis* G. R. Gray, 1867, South America.

Forms superspecies with *O. guttata* and *O. motmot*, and probably also with *O. leucogastra*. Has been included, together with *O. guttata*, in *O. motmot* (see page 313). *O. spixi* is a synonym. Monotypic.

Distribution. NE Brazil, S of R Amazon.



Descriptive notes. 42-46 cm. Smallest *Ortalis*, and only one with supercilary streak, which varies individually from buffy white to pale cinnamon.

Habitat. Thickets of scrub and forest, in lowlands.

Food and Feeding. No information available. **Breeding.** Dec-Feb. One nest was a fairly large, flat structure made of dry twigs. 2-3 eggs. No further information available.

Movements. No information available, but presumably sedentary.

Status and Conservation. Not globally threatened. Fairly common around Belém, Pará, and

scarce in São Luís area, N Maranhão.

Bibliography. Forrester (1993), Pinto (1964), Sick (1985a, 1993), Teixeira & Antas (1981), Vaurie (1965b)



Genus *PENELOPE* Merrem, 1786

13. Band-tailed Guan

Penelope argyrotis

French: Pénélope à queue barrée German: Bindenschwanzguan Spanish: Pava Camata

Taxonomy. *Pipile argyrotis* Bonaparte, 1856, Caracas.

Forms superspecies with *P. barbata*, with which often considered conspecific (see page 313). Race *colombiana* has been considered separate species. Race *albicauda* sometimes merged with nominate. Birds from W Venezuela and N Colombia, and from N Venezuela, sometimes awarded separate races, respectively *mesaeus* and *olivaceiceps*, but differences generally reckoned too slight to merit acceptance. Three subspecies recognized.

Subspecies and Distribution.

P. a. albicauda Phelps & Gilliard, 1940 - Sierra de Perijá, in Colombia and Venezuela.

P. a. colombiana Todd, 1912 - Santa Marta Mts, N Colombia.

P. a. argyrotis (Bonaparte, 1856) - N Colombia and N & W Venezuela.



Descriptive notes. 50-61 cm. Present species and *P. barbata* are only members of genus with tail feathers not uniformly coloured, as they have ill defined rufous, cinnamon or buffy white terminal band. Present species differs from *P. barbata* in conspicuous white markings on the upperwing-coverts, more prominent dewlap and more white on face, especially on the ear-coverts. Plumage of juvenile virtually indistinguishable from that of adult. Race *albicauda* generally similar to nominate but has buffy white tail tips: race *colombiana* has crown feathers edged white and more pointed than in nominate, and has

less white on supercilium.

Habitat. Dense forests in subtropical and upper tropical zones; prefers wet, virgin forest, but at times ventures into tall second growth, coffee plantations and upper edges of drier forest. Often in rugged, mountainous terrain; in Santa Marta Mts occurs at 1000-2000 m, rarely higher; in Venezuela found mainly between 800 m and 2400 m, although also present locally up to 3050 m and as low as 300 m, especially in NE. Favours very wet regions and so is generally commoner on seaward N slope of Venezuelan Cordillera.

Food and Feeding. Fruits, particularly pulpy ones, e.g. those of laurel and guarumo (*Cecropia*) trees; hard seeds are regurgitated. Occasionally comes to ground to take fallen fruit, but usually feeds in middle storey of trees. Drinks water caught in bromeliad leaf bracts, or in flowers of heliconias. Usually feeds in small groups of 3-5 birds, but more may gather at a fruit-laden tree.

Breeding. In Venezuela groups begin to break up, and territories to be established, in Jan; nests Feb-Apr, even May, with torrential rains coming at end of season; chicks in Apr and Jun in Santa Marta Mts, Colombia. Territorial; sometimes several territories close together. Nest is a loosely constructed, unwoven structure made of plant matter, usually placed 1-8 m above ground in trees of Rubiaceae. Chicks are uniform dark brown above, buffy brown and dull white below.

Movements. No information available, but presumably sedentary.

Status and Conservation. Not globally threatened. Locally common in many areas. Uncommon to fairly common, but infrequently seen, in Colombia, where threatened by deforestation in several areas; in 1990 status in Colombia classed as indeterminate, but probably at least vulnerable, particularly race *colombiana* endemic to Santa Marta Mts, a critical region for conservation. Uncommon in collections, but has been bred.

Bibliography. Carraker (1934), Fjeldså & Krabbe (1990), Hernández & Rodríguez (1988), Hilty & Brown (1986), Koenig (1961), Meyer de Schauensee & Phelps (1978), Porras & Arriaga (1981), Schäfer (1953a, 1954b), Strahl & Silva (1988), Todd & Carraker (1922), Vaurie (1966b).

14. Bearded Guan

Penelope barbata

French: Pénélope barbu German: Bartguan Spanish: Pava Barbuda

Taxonomy. *Penelope barbata* Chapman, 1921, Taraguacocha, Cordillera de Chilla, Ecuador. Often considered a race of *P. argyrotis*, with which forms superspecies (see page 313). Recently suggested to be race of *P. montagnii*. Peruvian population has been awarded separate race, *inexpectata*, but validity doubtful, as distinguishing characters of plumage, especially vermiculated belly, also reported in recent specimens from Ecuador, and may be an immature feature. Monotypic.

Distribution. S Ecuador and adjacent NW Peru.



Descriptive notes. c. 55 cm. Ill defined rufous terminal band in tail; present species and *P. argyrotis* are only members of *Penelope* with tail feathers not uniformly coloured. Differs from *P. argyrotis* by lack of conspicuous white markings on upperwing-coverts, fully feathered chin and upper throat, and partially feathered tarsus.

Habitat. Montane cloud forests, both humid and dry, in temperate and upper subtropical zone of W slope of Andes. Usually between 1500 m and 3000 m, but regularly down to 1200 m in Lambayeque, Peru. Sometimes found in small, relic forest patches.

Food and Feeding. Little information available, but known to feed mainly on fruits. One record of yellowish green fruits of an unidentifiable, probably undescribed, tree in S Ecuador. Large

quantities of undigested seeds in droppings might indicate that present species is important disperser of seeds. Reported to forage mainly in pairs or small groups of 3 or 4 (up to 8) individuals, often on ground.

Breeding. Several records, old and recent, of chicks between Dec and Mar, though in some localities chicks have been recorded in Jun and Jul. No further information available.

Movements. Presumably sedentary. Population in Podocarpus National Park evidently present all year round.

Status and Conservation. VULNERABLE/RARE. Populations only partly protected. Common at end of 19th century in N Peru and probably also in Ecuador until destruction of forest became so widespread. Uncommon in Peru in 1982; probably decreasing, but may still be fairly common in unexplored areas of its range. In Ecuador, where considered most threatened of all montane cracids, in 1989 total population estimated at 500-3000 pairs, probably c. 1500 pairs. Several populations occur in small patches of suitable habitat within larger areas almost devoid of forest. Viable populations in large Podocarpus National Park (S Ecuador), where at least 1000 km² of suitable habitat exists, with estimated density of 1 pair/km²; most of park (99%) was open to mining until 1993, when concession lifted due to international pressure campaign, and only a small part has been mined; casual gold prospectors and settlers, who had already established some dwellings and small-scale logging concerns inside park, are now pushing for access, and pressure likely to increase greatly in future; with some minor extensions, park could also include important populations of present species currently occurring just outside its limits. For protection of present species and several other threatened species, additional montane forest reserves badly needed, e.g. Cordillera de Chilla in Ecuador, and Cerro Chinguela, Ayabaca-Cruz Blanca area and upper valleys of R Sana and R Chanchay in Peru; in 1989, species seen 3 times at 2625 m during 4-day expedition to Ayabaca, where known to be suffering due to habitat destruction through logging in temperate zone, and where intensively hunted for food. In addition to habitat destruction, hunting pressure also blamed for species' decline in many areas; its confiding nature renders it especially vulnerable to this threat. Very rare in captivity; held in 1 collection in Mexico.

Bibliography. Best & Clarke (1991), Best *et al.* (1993), Bloch *et al.* (1991), Carraker (1934), Clarke (1990), Collar & Andrew (1988), Collar *et al.* (1992), Espinosa & Merino (1991), Fjeldså & Krabbe (1990), Koenig (1961), Ortiz, E. & O'Neill (1988), Ortiz, F. (1981), Parker, Parker & Plenge (1982), Parker, Schulenberg *et al.* (1985), Rahbek *et al.* (1989), Vaurie (1966b).

15. Baudo Guan

Penelope ortoni

French: Pénélope d'Orton German: Ortonguan Spanish: Pava de Orton
Other common names: Orton's Guan

Taxonomy. *Penelope ortoni* Salvin, 1874, Mindo, western slope of Pichincha, Ecuador. Has been considered a race of *P. montagnii*, but ranges contiguous, with overlap in W Ecuador and possibly also in SW Colombia, without any trace of intergradation, so they probably do not even form a superspecies; apparently closest to *P. marail* (see page 313). Monotypic.

Distribution. W Colombia and W Ecuador.



Descriptive notes. 58-63 cm. The only small *Penelope* without pale markings on head and wings.

Habitat. Humid forests, mainly in upper tropical zone, usually up to 1500 m. W of Andes; perhaps prefers broken country and foothills, but may also occur in lowland forests; in Colombia recorded between 100 m and 1500 m. Absent from dry coastal area of SW Ecuador.

Food and Feeding. No information available.

Breeding. No information available.

Movements. No information available, but presumably sedentary.

Status and Conservation. Not globally threatened. Currently considered near-threatened. Local in Colombia, where known only from a small number of localities; status in this country stated as vulnerable in 1990. Very rare in captivity; has been kept in one collection in Mexico.

Bibliography. Eley (1979, 1982), Hernández & Rodríguez (1988), Hilty & Brown (1986), Ortiz (1981), Vaurie (1966b).

16. Andean Guan

Penelope montagnii

French: Pénélope des Andes German: Andenguan Spanish: Pava Andina

Taxonomy. *Ortalia montagnii* Bonaparte, 1856, Colombia = El Piñón, above Fusagasugá. Has been considered to include *P. ortoni* as race, but ranges contiguous, with overlap in W Ecuador and possibly also in SW Colombia, without any trace of intergradation, so they probably do not even form superspecies. Population of SE Peru was separated in different race, *marcapatensis*, but later recognized as synonym of *plumosa*. Five subspecies recognized.

Subspecies and Distribution.

P. m. montagnii (Bonaparte, 1856) - NW Venezuela and N & C Colombia.

P. m. atrogularis Hellmayr & Conover, 1932 - W slope of Andes in S Colombia and Ecuador.

P. m. brooki Chubb, 1917 - E slope of Andes in S Colombia and Ecuador.

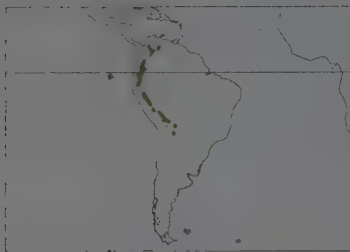
P. m. plumosa Berlepsch & Stolzmann, 1902 - E slope of Andes in Peru.

P. m. selateri G. R. Gray, 1860 - Yungas of Bolivia; usually said to occur in extreme N Argentina too, but this is based on two specimens recently shown to belong to *P. dabbeni*.

Descriptive notes. 51-61 cm; 818-840 g (*plumosa*). Stocky build, appearing less slender than most other *Penelope*. Throat and tarsus partially feathered, as in *P. barbata*, from which differs by uniformly coloured tail. Juvenile similar, but browner, with indistinctly vermiculated underparts and paler sides of face and throat. Races vary in slight differences of general plumage coloration and in pattern of markings on head and neck.

Habitat. Thick, epiphyte-rich humid forest in mountains, including dwarf forest. In temperate zone up to 3650 m, with one record at 3900 m at Pasco, Peru; occurs at higher altitudes than any other

On following pages. 17. Marail Guan (*Penelope marail*); 18. Rusty-margined Guan (*Penelope superciliosus*); 19. Red-faced Guan (*Penelope dabbeni*); 20. Crested Guan (*Penelope purpurascens*); 21. Cauca Guan (*Penelope perspicax*); 22. White-winged Guan (*Penelope albigularis*); 23. Spix's Guan (*Penelope jacquacu*); 24. Dusky-legged Guan (*Penelope obscura*); 25. White-crested Guan (*Penelope pileata*); 26. Chestnut-bellied Guan (*Penelope ochrogaster*); 27. White-browed Guan (*Penelope jacucaca*).



cracid; also present at times in subtropical mountain zone, as low as 1500 m. Occasionally ventures into tall second growth or open areas with fruiting trees.

Food and Feeding. Mainly fruits in 1-10 mm range. Forages in groups of 3-10 birds, sometimes individually, in middle and upper storeys of fruiting trees.

Breeding. One chick in Mar and a juvenile in Jun in Colombia. Nest is platform made of twigs, lined with leaves. 2 eggs; chicks are dark brown mixed with buff areas, and have an irregular white band along sides of crown.

Movements. Non-migratory, but performs

seasonal movements in search of fruit, sometimes leaving forest to move into second growth or even isolated trees. In Colombia stragglers recorded above and below normal altitudinal range.

Status and Conservation. Not globally threatened. Uncommon to fairly common in Colombia, and fairly common to common in Peru, where extensive inaccessible areas in E Andes suggest species may have healthy populations. Tolerates partly disturbed areas and frequently observed near human populations; survives in small highland forest patches unless persecuted. Considered vulnerable in Argentina by Dirección Nacional de Fauna; however, presence of species in Argentina based on two skins, both recently shown to be *P. dabbeni*. Suffers locally from habitat destruction for wood extraction or agriculture, and from limited hunting for local consumption. Uncommon in collections, but has been bred.

Bibliography. Blake (1962), Canevari & Caziani (1988), Fjeldså & Krabbe (1990), Hernández & Rodríguez (1988), Hilty & Brown (1986), Meyer de Schauensee & Phelps (1978), Olivares (1969), Olrog (1960), Ortiz, E. & O'Neill (1988), Ortiz, E. (1981), Parker *et al.* (1982), de la Peña (1992), Porras & Arriaga (1981), Remsen & Cardiff (1990), Remsen & T aylor (1989), Strahl & Silva (1988), Vaurie (1966b).

17. Marail Guan

Penelope marail

French: Pénélope marail

German: Marailguan

Spanish: Pava Marail

Other common names: Cayenne Guan

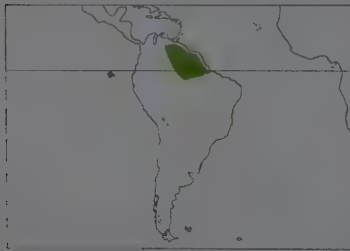
Taxonomy. *Phasianus Marail* P. L. S. Müller, 1776, Cayenne.

May form superspecies with *P. supercilialis*; also seems to be close to *P. ortoni* (see page 313). Has hybridized with *P. purpurascens* and *P. pileata* in captivity. Two subspecies recognized.

Subspecies and Distribution.

P. m. marail (P. L. S. Müller, 1776) - the Guianas and E Venezuela S of R Orinoco.

P. m. jacupeba Spix, 1825 - N Brazil and SE Venezuela.



Descriptive notes. 63-68 cm; 770-1015 g. Has greenish olive gloss on back, wings and central tail feathers, and bluish black lateral tail feathers. Race *jacupeba* is slightly smaller, paler and more greyish brown.

Habitat. Heavy tropical forest, especially near water, near coast or inland; less often in second growth. Occurs in lowlands; in Venezuela between 100 m and 600 m. In French Guiana found in pristine forest.

Food and Feeding. Almost exclusively fruit. Diet well studied in French Guiana; quite selective, with only 24 species of plant recorded, and 4 (*Euterpe oleracea*, *Eugenia coffeifolia*,

Guatteria sp. nov., *Minuartia guianensis*) accounting for 75% of all food taken; almost entirely frugivorous, and continues relying on fruits during dry season, when other sympatric, mainly frugivorous species increase their intake of flowers and other plant parts; insects very occasionally taken, representing less than 0.3% of diet. Forages singly or in small groups, mostly in trees, but sometimes on the ground.

Breeding. Laying Oct-Nov in French Guiana. Nest is cup-like; placed high in fork of tree. Lays 2-3 eggs; incubation 29 days (in captivity).

Movements. No information available, but presumably sedentary.

Status and Conservation. Not globally threatened. Common in many areas, e.g. in Surinam considered common in 1968. Widespread in French Guiana, but considered to be undergoing marked decline in areas with heavy hunting pressure. In Brazil fairly common in Amapá, N Rondônia and around Manaus, Amazonas. Uncommon in collections, but has been bred.

Bibliography. Amadon (1979), Eley (1979), Forrester (1993), Haverschmidt (1968), Meyer de Schauensee & Phelps (1978), Pinto (1964), Porras & Arriaga (1981), Sick (1985a, 1993), Snyder (1966), Strahl & Silva (1988), Théry *et al.* (1992), Thibault & Guyot (1988), Tostain *et al.* (1992), Vaurie (1964).

18. Rusty-margined Guan

Penelope supercilialis

French: Pénélope péoa

German: Weistiringuan

Spanish: Pava Yacupemba

Other common names: Superciliated/White-eyebrowed Guan

Taxonomy. *Penelope supercilialis* Temminck, 1815, state of Pará, Brazil.

May form superspecies with *P. marail*. Has hybridized in captivity with *P. purpurascens*, *P. pileata* and *Pipile cuman*. Recently, two new races have been described from the headwaters of the Mamé River, Amazonas (*cyanosparius*), and the coast of Alagoas and Pernambuco (*alagoensis*), but the types and paratypes are of captive origin. Three subspecies usually recognized.

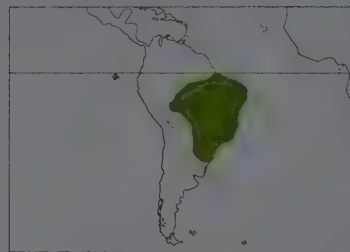
Subspecies and Distribution.

P. s. supercilialis Temminck, 1815 - NC & E Brazil, S of Amazon S to Maranhão.

P. s. jacupemba Spix, 1825 - E Bolivia (Santa Cruz) and C & S Brazil.

P. s. major Berton, 1901 - extreme S Brazil (Santa Catarina, Rio Grande do Sul), E Paraguay and NE Argentina (Misiones).

Descriptive notes. 55-73 cm; 950-1150 g (*superciliaris*), 750-880 g (*jacupemba*). Pale supercilium, black earcoverts and chestnut-orange edgings of inner wing feathers. Immature very similar to adult. Races vary in size, tone of general coloration and broadness and tone of wing feather fringes; supercilium also differs, in *jacupemba* being very distinct and often ochraceous or rich buff, rather than white.



Habitat. Heavy forest, forest borders, gallery forest, *capoeira*, forest groves in *cerrado* woodlands, *caatinga*, river and lake edges. Usually in lowlands; recorded at 1100 m at Serra do Japi, São Paulo.

Food and Feeding. Mainly fruits, including those of bicuiba (*Virola*), sapacaiá (*Lecythis*), murici (*Byrsonima*), aricanga palm (*Geonoma*), guarumo (*Cecropia*), *Schinus*, *Psidium*, *Syagrus* and *Byrbiuba*; fruits of two exotic species, *Coffea arabica* (Africa) and *Eriobotrya japonica* (Asia), also found to constitute important part of diet in São Paulo; in this study, present species was considered to be

non-specialized frugivore, both in terms of species and size of fruits taken; some insects occasionally taken, both adults (Hymenoptera, Coleoptera) and larvae (Lepidoptera). Although primarily arboreal, occurring at variable levels, is often recorded feeding on ground. Forages singly, in pairs, or in groups of up to 10 birds.

Breeding. Oct-Feb in N Argentina. Nest is a platform of twigs, lined with leaves and stems, located in a tree. Lays 3 eggs; incubation 28 days (26-27 in captivity).

Movements. Sedentary. In study at several sites in São Paulo, daily altitudinal movements detected, involving vertical differences of up to 400 m: in Mata do Pau Furado and in Serra do Japi, birds usually spend night in highest parts and move down to feed in lower parts.

Status and Conservation. Not globally threatened. Nominate race has apparently declined in many parts of range; not recorded since at least 1960 from around Belém and Santarém, Pará; scarce in Amazônia (Tapajós) National Park, Pará. Race *jacupemba* still fairly common in many parts of range, including several national parks, but has been extirpated or has declined considerably in others; occurs with small, isolated populations in São Paulo; reported to be rare in the Poconé region (Pantanal), Mato Grosso. Race *major* has a very restricted distribution in Argentina; currently frequent in Iguazú National Park (55,000 ha), Misiones, especially in the core area, where birds are quite tame; also present in Uruguá-i Provincial Park, Misiones, where 4-5 birds seen in 1985; unrecorded recently in other areas of Argentina, although Arroyo Aguarray-Guazú region, where the species was common at least until 1940's, has not been surveyed in recent times. Collected in Rio Grande do Sul, S Brazil, up to end of 19th century, but no recent records. Despite legal protection, known to be hunted in N Argentina. Uncommon in collections, but has been bred.

Bibliography. Bege & Marer (1991), Belton (1984), Canevari & Caziani (1988), Chebez (1990), Cintra & Yamashita (1990), Dubs (1992), Eley (1979), Forrester (1993), Guix (1994), Kuhlman (1946), Nardelli (1993), Neumann (1933), Nores & Yzurieta (1988), de la Peña (1992), Pinto (1964), Remsen & T aylor (1983, 1989), Sick (1970, 1985a, 1993), Taibel (1953), Teixeira & Antas (1981), Vaurie (1966b).

19. Red-faced Guan

Penelope dabbeni

French: Pénélope de Dabbene

German: Rotgesichtguan

Spanish: Pava Carirroja

Other common names: Dabbene's Guan

Taxonomy. *Penelope dabbeni* Hellmayr and Conover, 1942, Cerro de Calilegua, Ledesma, Jujuy, Argentina.

Usually regarded as an isolated relative of *P. obscura*, although sometimes considered to be more closely related to *P. montanii*. *P. nigrifrons* is a synonym. Monotypic.

Distribution. S Bolivia (S Santa Cruz, Chuquisaca and Tarija) and NW Argentina (Jujuy and Salta).



Descriptive notes. 63-69 cm; one bird 1230 g. Only species of *Penelope* with bright red bare facial skin.

Habitat. Large tracts of cloud forest on slopes of E Andes, with presence of large trees, e.g. cedars (*Cedrela*), *Eugenia* or *Blepharocalyx*; in highest parts of range forest is dominated by alders (*Alnus*). Found mainly between 1800 m and 2500 m; occasionally as low as 800 m, or as high as 2700 m.

Food and Feeding. No information available on diet. Forages mainly in trees; usually in pairs, but a group of c. 25 birds recently reported from Bolivia.

Breeding. Displaying and calling pairs recorded in Sept-Oct in Bolivia. Nest is a platform made of twigs and stems, lined with leaves, placed in a tree. 3 eggs.

Movements. No information available, but presumably sedentary.

Status and Conservation. Not globally threatened. Currently considered near-threatened. Scarce and local. In Argentina, common in Calilegua National Park (76,000 ha), Jujuy, where relatively well protected, more by inaccessibility and isolation than by adequate wardening. Only other confirmed reports of recent occurrence of species in Argentina are 3 specimens collected in 1976 at Río Lipeo and Los Toldos, Salta. Species may also be present in the isolated Baritú National Park (72,000 ha), Salta, which lies within its range, but there are no records. Considered vulnerable in Argentina by Dirección Nacional de Fauna. Any populations outside national parks probably suffer hunting pressure. In Bolivia, species had not been recorded during recent decades and considerable reduction of its habitat has been reported in O'Connor and Arce Provinces, Tarija. However, in 1991, a sizeable population was discovered in C Chuquisaca, with density of c. 5 pairs/km², and estimated total of 3000 pairs; a few birds were also seen near Vallegrande, S Santa Cruz, indicating a range extension to N; a population of similar size may inhabit an area N of R Pilcomayo. The population discovered in Chuquisaca was not suffering severe hunting pressure, and at present benefits from absence of roads in the area.

Bibliography. Bond & Meyer de Schauensee (1942/43), Canevari & Caziani (1988), Collar & Andrew (1988), Fjeldså & Krabbe (1990), Fjeldså & Mayr (1994), Nores & Yzurieta (1988), Olrog (1960, 1984), de la Peña (1992), Remsen & T aylor (1989), Vaurie (1966b).

20. Crested Guan

Penelope purpurascens

French: Pénélope panachée

German: Rostbauchguan

Spanish: Pava Cojolita

Other common names: Purple/Purplish Guan

Taxonomy. *Penelope purpurascens* Wagler, 1830, Mexico.

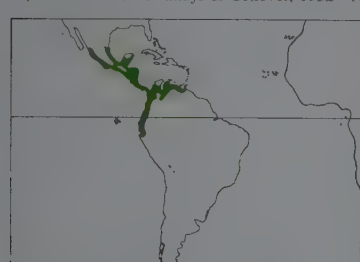
Forms superspecies with *P. perspicax*, *P. albipennis*, *P. jacquacu* and *P. obscura*. *P. cristata* is a synonym. Has hybridized with *P. marail*, *P. pileata* and *P. superciliosa* in captivity. *P. jacquacu* formerly considered race of present species, but tracheal morphology is different (see page 319). Three subspecies recognized.

Subspecies and Distribution.

P. p. purpurascens Wagler, 1830 - NW & NE Mexico S to Honduras and Nicaragua.

P. p. aequatorialis Salvadori & Festa, 1900 - S Honduras and Nicaragua S to NW Colombia and SE Ecuador; possibly also to extreme N Peru.

P. p. brunescens Hellmayr & Conover, 1932 - N Colombia to E Venezuela.



Descriptive notes. 72-91 cm; 1620-2430 g. Largest member of genus. Has bushy crest, which is often erected, and conspicuous white fringes on foreneck and breast feathers. Juvenile similar to adult, but wing and tail feathers washed with rufous brown, and mottled with blackish brown. Nominative race has white edges on scapulars and mantle feathers, and is larger and less rufescent than the two other races; *aequatorialis* is similar to *brunescens*, but less rufous, especially on the rump and central rectrices.

Habitat. Generally in humid forest and forest borders of tropical and lower subtropical zones; more often in lowlands or hilly areas below 1000 m, but locally or seasonally up to 2300 m or even 3000 m; in Darién, E Panama, commonest up to 1000 m and in smaller numbers to 1450 m. Occasionally ventures into gallery forest, e.g. in Venezuela or N Colombia. Locally found in some drier habitats, e.g. in oak-sweetgum and beech forest in Tamaulipas, NE Mexico, or in humid pine-oak forest in Colima, WC Mexico; absent from open savannas.

Food and Feeding. Berries, figs and other fruits, including those of *Spondias*, *Bumelia*, *Gutteraria*, *Chione*, *Cecropia* and wild papaya; known to be one of the dispersers of wild nutmeg (*Viola surinamensis*), seeds of which it regurgitates. Also consumes seeds, leaves, young shoots and flowers; occasionally takes insects, such as beetles, from ground. Forages singly, in pairs, or in groups of up to 8 birds, usually in high branches of trees; sometimes comes to ground to pick up fallen fruits or scratch for seeds, or to drink.

Breeding. Mar-Jun in Mexico and in Costa Rica; during rainy season in Panama, with chicks in Feb-Mar; Mar-May in N Colombia; Mar-Jul in Venezuela. Nest is a rather bulky platform of twigs and sticks, lined with leaves, placed in a tree well above the ground, or occasionally on top of a stump. Usually 2 eggs, but 3 also recorded; chicks are rich chestnut above mottled buff and black, with reddish brown breast and flanks and white belly. Sexual maturity probably at 2 years old.

Movements. Sedentary, although some seasonal altitudinal movements may occur in mountainous regions.

Status and Conservation. Not globally threatened. Fairly common in Guatemala, especially on Caribbean slope; still persists in fair numbers in areas of Pacific slope where *Crax rubra* has long since disappeared. Maintains stable populations throughout vast areas in Nicaragua. In Costa Rica has disappeared from deforested country and is becoming rare in unprotected forests. Still fairly common in Panama, in areas where hunting pressure is not too great; commoner on Caribbean slope, while on Pacific slope seems to be restricted to a few areas; in 1989 was considered virtually extirpated from Chiriquí Province; well protected in Barro Colorado Biological Reserve. Heavily hunted for food and sport, although often remains in suitable areas after hunting has led to disappearance of larger sympatric *Crax rubra*; in some rural areas of Panama, especially in Darién, sold for food in local markets. Most common species of *Penelope* in captivity in Europe and North America; frequently bred. CITES III in Honduras.

Bibliography. Alvarez del Toro (1981b), Belterman & de Boer (1990), Dickerman (1987a), Eley (1979, 1982), Fjeldså & Krabbe (1990), González (1986), Griscom (1932), Hernández & Rodríguez (1988), Hilly & Brown (1986), Howe & Vande Kerkhove (1980), Land (1970), Leopold (1959), Lowery & Dalquest (1951), Meyer de Schauensee & Phelps (1978), Mondragón & Baez (1981), Monroe (1968), Ortega & Aragón (1981), Ortiz (1981), Porras & Arriaga (1981), Ridgely & Gwynne (1989), Ridgway & Friedmann (1946), Rowley (1984), Saunders (1950), Schudach (1963), Slud (1964), Smith (1966), Stiles & Skutch (1989), Strahl & Silva (1988), Taibel (1955, 1957), Vannini & Rockstroh (1988), Vaurie (1966a), Wetmore (1965), Zepeda (1981).

21. Cauca Guan

Penelope perspicax

French: Pénélope de Cauca

German: Caucaguan

Spanish: Pava del Cauca

Taxonomy. *Penelope perspicax* Bangs, 1911, San Luis, Bitaco Valley, western Colombia.

Has long been considered a race of either *P. jacquacu* or *P. purpurascens* (see page 313). Forms superspecies with these two and also *P. albipennis* and *P. obscura*. Monotypic.

Distribution. W Colombia, on both slopes of W Andes and W slopes of C Andes; almost wholly confined to middle and upper Cauca Valley. Much rarer on W slopes of W Andes, where seen mainly in low passes.



Descriptive notes. c. 76 cm. Back, rump, wings, belly and tail mainly rich chestnut; belly and thighs have some inconspicuous darker markings. Outer tail feathers darker than those of centre.

Habitat. Humid forest in upper tropical and subtropical zones, between 1300 m and 2100 m. Occurs both in primary forest and second growth, and even in groves near tracks.

Food and Feeding. Habits presently under study in protected areas where species survives. Forages in flocks of up to 16 birds, from low trees and shrubs almost to canopy, mainly 3-20 m above ground level.

Breeding. One egg collected in May, but this record is unsatisfactory as well outside range; one juvenile, one third grown, collected in Mar. Two nests recorded, both with 2 eggs. No further information available.

Movements. No information available; presumably sedentary.

Status and Conservation. RARE. Populations largely protected, but vigilance needed. Considered not uncommon at beginning of 20th century, but much scarcer since then, as a result mainly of habitat loss. Before mid 1980's, scarcity of recent records and almost complete destruction of

forest in middle Cauca Valley led to belief that species was possibly extinct, or very nearly so. However, recent observations and the capture of live birds show that small but stable populations still remain, at least in a few areas. Density in Ucumari Regional Park apparently quite high, with 16 birds counted over 2 days in 1990. Also receives protection in Bosque de Yotoco Reserve, where squatters have been effectively excluded; rare in Munchique National Park, although extensive forest remains. Although forest destruction is main threat, hunting has probably also contributed to decline of species; poaching is widespread in Ucumari Regional Park and Munchique National Park.

Bibliography. Collar & Andrew (1988), Collar *et al.* (1992), Eley (1982), Hellmayr & Conover (1932), Hernández & Rodríguez (1988), Hilly & Brown (1986), King (1978/79), Negret (1991), Vaurie (1966a).

22. White-winged Guan

Penelope albipennis

French: Pénélope à ailes blanches

German: Weischwingenguan

Spanish: Pava Aliblanca

Taxonomy. *Penelope albipennis* Taczanowski, 1877, near Tumbes, Peru; type from Santa Lucia. Forms superspecies with *P. purpurascens*, *P. perspicax*, *P. jacquacu* and *P. obscura*. Probably closely related to *P. purpurascens* or *P. jacquacu* (see page 314), but specific status now warranted; validity as species questioned in past, with suggestions that it had been described from a partially albinistic specimen of *P. orioni* or *P. purpurascens*, or that it constituted a morph or variant of one of these species. Monotypic.

Distribution. Extreme NW Peru; recent records only from Lambayeque; historically, also occurred in Tumbes and Piura, where some populations may persist. Original range supposed to extend N to near border with Ecuador, and S to R Chicama, La Libertad. Might also be present in large swampy area bordering Gulf of Guayaquil, in SW Ecuador.



Descriptive notes. c. 70 cm. Only *Penelope* with white primaries (eight outer primaries) and bright blue bill with blackish tip. Also has purplish blue bare skin around eye and large dewlap, with two lobes, deep orange rather than red.

Habitat. Localities currently known to be occupied are on slopes and ravines covered with dry deciduous forest in foothills of W Andes, mainly between 300 m and 900 m, sometimes up to 1200 m. Valleys with permanent streams, safe cover, food plants and little human disturbance; seems to prefer wettest parts, especially during dry season; valleys without permanent water can be visited temporarily. Has also occurred in coastal gallery forest, e.g. on islands in delta of R Tumbes with trees characteristic of dry forest, and densely fringed with mangroves.

Food and Feeding. Mostly plant matter of different kinds, varying throughout year according to cycles of species consumed. Fruits of fig trees (*Ficus*) are particularly favoured when ripe; other fruits include berries of *Celtis iguanea*, drupes of *Geoffroea striata*, and pods of *Pithecellobium*, *Prosopis*, *Acacia*, *Caesalpinia*. Flowers can be eaten whole (*Encelia*) or only petals (*Ervithina*). Also feeds on buds (*Encelia*, *Alternanthera*), leaves (*Encelia*) and seeds, extracted mainly from fruit of *Celtis trichistandra*. Shoots of maize, sweet potatoes and beans taken during occasional visits to fields in Apr, while coffee fruits have been recorded only in one area. Possibly a few insects also eaten. Main food in coastal habitats (Condessa I, Tumbes), at least in Jan-Feb, were berries of buckthorn (*Scutia spicata*), apparently supplemented with pods of mesquite (*Prosopis chilensis*). Drinks early in morning, usually at valley bottom. Usually forages in pairs or small family groups, or in groups of up to 10 birds during non-breeding season.

Breeding. One nest with eggs found in May in Lambayeque, and one old record of chicks in Jan in coastal Tumbes. Only confirmed nest of species was a structure made of twigs and leaves, some still green, situated 2.5 m up a small tree in dense forest; old record of nest, loosely composed of dry sticks and placed c. 3 m above ground, not confirmed to refer to present species. Nest in Lambayeque had 3 infertile eggs. Chicks have yellowish and black down above, paler below.

Movements. Mainly sedentary, but some local movements known. Thought to be merely vagrant in at least 4 of localities where recently recorded. Movements may have certain seasonality, mainly related to rains; birds known to concentrate in evergreen thickets at height of dry season; only known to visit Jagway Grande in Jul-Dec.

Status and Conservation. ENDANGERED. Situation critical: action urgent. Presumed extinct shortly after its discovery in 1876 and for a whole century thereafter, until rediscovered in 1977. Recent records from some 26 localities, of which at least 17 are suspected to hold breeding pairs; population reckoned to be very small at each site, with only 1-4 pairs. Many other valleys in same area have been surveyed and found not to hold species, and the discovery of many other populations within current range is unlikely. Total population at time of rediscovery estimated to number a few hundred birds or possibly fewer than 100, with a minimum of 54-68 counted; in late 1980's under 200 were observed and total population now estimated to be a few hundred. Population seems to have declined recently, notably after land reforms of 1968, which permitted public access to much land previously belonging to large estates. Main threat nowadays is habitat destruction, with trees being felled for charcoal or wood and establishment of new areas of cultivation. Hunting with firearms or slings is another threat, especially in some places; identified as sole cause of extinction around Tumbes between 1850 and 1877; hunting pressure along coast also suspected as main reason for apparent restriction of species to Andean foothills. After rediscovery of species, RARE and WCI have funded research and conservation of species; species and habitat now legally protected, although apparently not effectively; reserve at Quebrada Negrohuasi has also been created within current range. Species not recorded by 1989 expedition to Sozoranga Mts, S Ecuador. Captive breeding centre near Olmos, financed by Stichting Crax, held 23 birds and 4 breeding pairs in 1990; long-term aim is reintroduction of species into natural habitats.

Bibliography. Clarke (1990), Collar & Andrew (1988), Collar *et al.* (1992), Dejonghe & Mallet (1978), Díaz Montes (1991), Eley (1979, 1982), King (1978/79), de Macedo-Ruiz (1978, 1979a, 1979b), O'Neill (1978), O'Neill *et al.* (1981), Ortiz, E. (1980), Ortiz, E. & O'Neill (1988), Ortiz, E. & Parisaca (1981), Ortiz, E. (1981), Schulenberg & Parker (1981), del Solar (1988), Taczanowski (1884-1886), Vaurie (1966b), Williams (1980)

23. Spix's Guan

Penelope jacquacu

French: Pénélope de Spix

German: Spixguan

Spanish: Pava Amazónica

Other common names: White-browed Guan(?); Green-backed Guan (*granti*)

Taxonomy. *Penelope jacquacu* Spix, 1825, "in sylvis fl. Solimões".

Has been considered conspecific with *P. obscura*, and formerly with *P. purpurascens*, but tracheal morphology different (see page 319). Forms superspecies with *P. purpurascens*, *P. perspicax*, *P. albipennis* and *P. obscura*. Race *granti* has been considered separate species, including *orienticola* as race, but there is extensive intergradation throughout present species. Has hybridized with *P. pileata* in captivity. Four subspecies recognized.

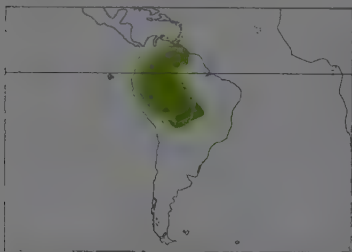
Subspecies and Distribution.

P. j. granti Berlepsch, 1908 - Guyana and adjacent E Venezuela S of R Orinoco.

P. j. orienticola Todd, 1932 - SE Venezuela and NW Brazil N of R Amazon and R Solimes.

P. j. jacquacu Spix, 1825 - Amazonia S of R Amazon and R Solimes in W Brazil, E Colombia, E Ecuador, Peru and N Bolivia.

P. j. speciosa Todd, 1915 - C & E Bolivia.



Descriptive notes. 66-76 cm; male 1242-1360 g (*jacquacu*), 1400-1778 g (*orienticola*); female 1142 g (*jacquacu*), 1270-1716 g (*orienticola*). Coloration of races *jacquacu* and *granti* markedly different. Nominate has bronzy olive green upperparts and bright rufescent underparts from lower foreneck to undertail-coverts. Race *granti* somewhat larger and much darker overall, with bluish green gloss on upperparts; easily distinguished from *P. obscura* by pale red legs. Race *speciosa* similar to nominate, but has more white on forehead, supercilium and ear-coverts. Race *orienticola* intermediate between *granti* and nominate in both size and coloration.

Habitat. Humid rain and cloud forest, including both *terra firme* and seasonally flooded forest. Also in forest borders, slashed clearings with scattered trees and gallery forest. In tropical zone; locally in lower subtropical zone. In Venezuela between 100 m and 1800 m; in Colombia, in lowlands and foothills at E base of Andes, up to 500 m; at any altitude, up to 1500 m, in Peru. **Food and Feeding.** Small fruits (e.g. of palms) and seeds have been found in gizzards of collected birds; apparently prefers ripe, soft fruit. Forages singly, in pairs or in small family groups, mainly in middle and top strata of trees; seldom descends to ground.

Breeding. Mostly Jan-Apr in NE Venezuela; one nest in Apr and one male in breeding condition in Aug in Colombia; said to begin in Aug-Sept in Peru. One nest was made mostly of leaves and situated in a tree c. 5 m above the ground. 2 eggs (in captivity).

Movements. No information available; presumably sedentary.

Status and Conservation. Not globally threatened. Common in many parts of range, except in densely populated areas or where forest has been destroyed. In populated areas seems to have changed its habits, becoming shyer, and is often heard although very rarely seen; has managed to survive near Iquitos, Peru. In Peru, where usually regarded as common, reported to be rare along R Napo and in Coshipata Valley, and feared to have been extirpated in parts of Huallaga and Ucayali Valleys due to conversion of habitat for agriculture. In Ecuador, still common in undisturbed forests, with estimated density of 8-2 birds/km² in river edge forests. In Brazil, fairly common in many parts of range, including N Roraima, Pico da Neblina National Park and around cities of Manaus and Tefé (Amazonas) and around R Branco; also fairly common in Acre and Rondônia. Hunted for local food consumption in many parts of range, and locally for commercial purposes. Effective protection in Tambopata Reservation Area, Peru, has led to marked recovery of population, with threefold increase in numbers over 10 years. Quite common in captivity, where frequently bred.

Bibliography. Conover & Phelps (1947), Eley (1979, 1982), Forrester (1993), Hernández & Rodríguez (1988), Hilty & Brown (1986), Johnson (1993), Meyer de Schauensee & Phelps (1978), Olivares & Hernández (1962), Ortiz, E. & O'Neill (1988), Ortiz, F. (1981), Parker *et al.* (1982), Pinto (1964), Porras & Arriaga (1981), Remsen & T aylor (1989), Sasaki *et al.* (1982), Sick (1965, 1985a, 1993), Snyder (1966), Strahl & Silva (1988), Terborgh & Weske (1975), Vaurie (1966a), Willard *et al.* (1991).

24. Dusky-legged Guan

Penelope obscura

French: Pénélope yacouhou

German: Bronzeguan

Spanish: Pava Oscura

Other common names: Dusky/Common Guan

Taxonomy. *Penelope obscura* Temminck, 1815, Paraguay, ex Azara.

Has been considered conspecific with *P. jacquacu*, but tracheal morphology is different (see page 319). Forms superspecies with *P. purpurascens*, *P. perspicax*, *P. albipennis* and *P. jacquacu*. Three subspecies recognized.

Subspecies and Distribution.

P. o. bronzinga Hellmayr, 1914 - E Brazil (Espírito Santo to Santa Catarina).

P. o. obscura Temminck, 1815 - SE Paraguay, NE Argentina, Uruguay and extreme S Brazil (Rio Grande do Sul).

P. o. bridgesi G. R. Gray, 1860 - C Bolivia S to NW Argentina, on E slope of Andes.



Descriptive notes. 68-75 cm; 960-1200 g. Only member of genus with dark legs; overall plumage and bare facial skin also dark. Races vary in size, tone of general coloration and markings. Nominate race is darkest and smallest, with well developed whitish streaks only on foreneck and breast; race *bronzinga* has more conspicuous white edges on feathers of head, forming well developed supercilium; race *bridgesi* largest, with prominent purer white streaks on neck and breast, and also on scapulars and wing-coverts, but supercilium faint or absent.

Habitat. Tall forest, gallery forest, small river islands with forest surrounded by grassland; also in montane forest up to 2200 m, where lower country is too dry for evergreen forest, or forest has been destroyed; sometimes ventures into scrub and agricultural land. May be scarce in densest forests, perhaps due to abundance of mammalian predators and preference for feeding on ground. In El Rey National Park, NW Argentina, commonest below 1000 m, especially in ecotones between Chaco woodland and denser, more humid forest. Race *bridgesi* in Bolivia most often found at higher altitudes, especially in N of range, where approaches that of *P. jacquacu*.

woodland patches and second growth in lowlands and foothills of tropical and upper tropical zones; also in montane forest up to 2200 m, where lower country is too dry for evergreen forest, or forest has been destroyed; sometimes ventures into scrub and agricultural land. May be scarce in densest forests, perhaps due to abundance of mammalian predators and preference for feeding on ground. In El Rey National Park, NW Argentina, commonest below 1000 m, especially in ecotones between Chaco woodland and denser, more humid forest. Race *bridgesi* in Bolivia most often found at higher altitudes, especially in N of range, where approaches that of *P. jacquacu*.

Food and Feeding. Fruits, including those of *Eugenia uruguayensis*, *Citharoxylum montevidense*, *Rapanea lorentziana*, *Didymopanax*, *Calyptanthus* and *Croton*; also those of certain palms, which are apparently favourite food in Paraguay; recorded invading poultry yards to feed on corn in Rio Grande do Sul; study in São Paulo suggests species is rather specialized frugivore. In El Rey National Park, NW Argentina, birds feed mainly on leaves, complemented with available fruit during winter; mostly fruits in Nov-Mar (wet season); seeds also found in droppings, indicating species may be important as disperser of seeds. Forages singly, in pairs or in small parties, usually up to 6 birds, although as many as 30 recorded; mainly in trees, especially in lower and middle storeys, but often on ground. Drinks at dawn at rivers, pools or forest streams.

Breeding. In NW Argentina pair formation in Nov and chicks in early Jan (*bridgesi*); one half-grown juvenile seen with adult in Jan in Rio Grande do Sul (*obscura*). Nest is cup-like, made of twigs and stems, lined with leaves, situated in a tree, usually well hidden in dense tangle of vegetation, c. 3 m above ground. Usually 2-3 eggs (up to 4); can lay two clutches in same year; incubation c. 28 days.

Movements. Presumably sedentary, but in NW Argentina (*bridgesi*) may use of different vegetation levels throughout year. No further information available.

Status and Conservation. Not globally threatened. Race *bronzinga* has declined drastically in state of São Paulo, Brazil, and was considered globally vulnerable in 1990 by ICBP/IUCN International Cracidae Specialist Group. Nominate race said to survive in substantial numbers in Uruguay, especially in thick woodlands of N; also in many areas of Rio Grande do Sul, Brazil, which has been considered as indication that illegal hunting for food or sport by locals is not a significant threat there; fairly common in several protected areas, e.g. Aparados da Serra National Park, Rio Grande do Sul, and Iguacu National Park, Paraná. Recently said to be local and generally scarce in N Argentina, where known to be common during 19th century; 4-5 pairs seen in 1985-1986 in Reserva El Bagual (Presidente Irigoyen), Formosa, and minimum 30 birds estimated in c. 1000 ha of islands in Paraná Delta, Buenos Aires, where surrounding habitat is being rapidly deforested or converted into plantations; recently seen in secondary forest. Race *bridgesi* abundant in El Rey National Park (44,000 ha), NW Argentina, where seen in all habitats, but outside park closely tied to montane forest, which is less altered than Chaco and pre-montane forests in region. Also present in Baritú National Park (72,000 ha), Salta, and Calilegua National Park (76,000 ha), Jujuy; both parks have little vigilance, but inaccessibility and isolation provide protection. Much reduced, with several local extinctions, in Tucumán and in populated areas in general, due to habitat alteration and hunting. Considered vulnerable in Argentina by Dirección General de Fauna, and said to be decreasing in numbers except in a few national parks; both races in this country intensively hunted for food and sport, despite legal protection. Kept and bred in captivity locally and in a few collections abroad.

Bibliography. Bege & Marterer (1991), Belton (1984), Brown, A. (1986), Canevari & Cazzani (1988), Caviglia (1981), Césari & Domínguez Alonso (1974), Dinelli (1929), Eley (1979, 1982), Forrester (1993), Gore & Gepp (1978), Guix (1994), Guix *et al.* (1992), Kuhlman (1946), Nogueira Neto (1973), Nores & Yzurietta (1988), de la Peña (1992), Pinto (1964), Remsen & T aylor (1989), Scott & Brooke (1985), Sick (1985a, 1993), Teixeira & Antas (1981), Vaurie (1966a).

25. White-crested Guan

Penelope pileata

French: Pénélope à poitrine rousse German: Weischopfguan Spanish: Pava Crestiblanca

Other common names: White-headed/Green-backed/Pileated Guan

Taxonomy. *Penelope pileata* Wagler, 1830, state of Pará, Brazil.

Forms superspecies with *P. jacquacu* and *P. ochrogaster*, and all three once considered conspecific. Has hybridized in captivity with, at least, *P. superciliosus*, *P. marail*, *P. jacquacu*, *P. jacquacu* and *P. purpurascens*, and even with *Crax alberti*, Montepic.

Distribution. NC Brazil, in relatively small area S of R Amazon, from lower R Madeira to lower R Tapajós.



Descriptive notes. 75-82.5 cm; 1100-1600 g. Most colourful member of genus, with marked contrast between glossy dark greenish olive on most of upperparts and rich chestnut rufous on underparts. Rufous hindneck and upper mantle, contrasting with rest of mantle, back, wings and tail, clearly distinguish present species from *P. ochrogaster*; also has more black on face, especially on ear-coverts. Juvenile similar to adult, but duller, with paler eye.

Habitat. Forest in lowlands; seems to occur exclusively in rather dense forest, although general ecology still poorly known.

Food and Feeding. No information available.

Breeding. Lays 4 eggs in captivity, although 3 probably commoner; chicks have upperparts patterned with dark brown, ashy grey, yellowish grey and blackish. No further information available.

Movements. No information available, but presumably sedentary.

Status and Conservation. Not globally threatened. Currently considered near-threatened. Apparently confined to heavy forest. Fairly common in Amazonia (Tapajós) National Park; scarce around Santarém, Pará. Uncommon in collections, but has been bred, e.g. in Sorocaba Zoological Park, Brazil, and Cracid Breeding and Conservation Centre in Lanaken, Belgium.

Bibliography. Eley (1979), Forrester (1993), Pinto (1964), Rutgers & Norris (1970), Sick (1965, 1985a, 1993), Taibel (1957), Vaurie (1966b).

26. Chestnut-bellied Guan

Penelope ochrogaster

French: Pénélope à ventre roux

German: Rotbrustguan

Spanish: Pava Ventrirrufo

Taxonomy. *Penelope ochrogaster* Pelzeln, 1870, nas Frechas and Engenho do Pari, near Cuyabá, Mato Grosso.

Forms superspecies with *P. jacquacu* and *P. pileata*, and all three once considered conspecific. Monotypic.

Distribution. Scattered localities in C Brazil, from Goiás to W Minas Gerais and S Mato Grosso. Possibly also to be found in adjacent areas of Bolivia, where appropriate habitat of species is widespread.



Descriptive notes. 67-5-75 cm. Recalls *P. pileata*, but plumage less contrasted, mainly because upperparts paler; hindneck of same general colour as rest of upperparts; browner ear-coverts. Black band bordering bare facial skin and throat, and richer rufous underparts, distinguish present species from *P. jacquacu*.

Habitat. Typically occurs in swampy woods of deciduous trees and also savannas, in lowlands. Probably prefers heavily wooded areas along rivers or in swamps; also inhabits mixed areas of forest interspersed with savanna or *campo*. Preferred habitat in Poconé

region, Mato Grosso, is semi-deciduous gallery forest growing on higher terrain that is rarely flooded; during the dry season these areas generally have a heavy covering of leaf litter on the ground.

Food and Feeding. Virtually no information available. Recorded feeding on the flowers of a *Tubebuia* tree.

Breeding. Clutch size recorded as consisting of 2 eggs. No further information available.

Movements. No information available, but presumably sedentary.

Status and Conservation. VULNERABLE/RARE. Populations only partly protected. Has been considered very rare; in contrast, some authorities state species to be uncommon, but not particularly threatened. Very few specimen and sight records, suggesting low population size, or at least that species is either highly localized or highly secretive. Rarest cracid in semi-deciduous forest in the Pantanal; appears to be moderately common around Poconé, Mato Grosso, where hunting pressure is relatively limited; not recorded since at least 1960 from Barranquinho, SW Mato Grosso. No threats definitely known, but species is presumably hunted for food and probably suffering some habitat loss, given considerable agricultural development occurring within its range. Occurs within Araguaia National Park, and at least around periphery of Pantanal National Park. Very rare in captivity.

Bibliography. Cintra & Yamashita (1990), Collar & Andrew (1988), Collar *et al.* (1992), Dubs (1992), Eley (1979), Naumburg (1930), Pinto (1952a, 1964), Pinto & de Camargo (1952), Sick (1985a, 1993), Vaurie (1966b).

27. White-browed Guan

Penelope jacucaca

French: Pénélope à front blanc

German: Weibrauenguan

Spanish: Pava Yacucaca

Other common names: Brown Guan

Taxonomy. *Penelope jacu-caca* Spix, 1825, near Poçoens Encima, Bahia.

Forms superspecies with *P. ochrogaster* and *P. pileata*, and all three once considered conspecific. Has hybridized with *P. pileata* in captivity. Monotypic.

Distribution. Interior of NE Brazil.



Descriptive notes. 65-70 cm. Conspicuous white supercilium with a narrow black line below, separating it from bare skin of sides of face. White streaks on upperwing elongated and prominent, more so than in *P. obscura bronzina*, from which present species also differs by having more contrasting supercilium and pale legs. Juvenile similar, with softer plumage; browner on breast.

Habitat. Inhabits dry areas of stunted forest and *caatinga*. In lowlands.

Food and Feeding. No information available on diet. Sometimes comes to ground to feed.

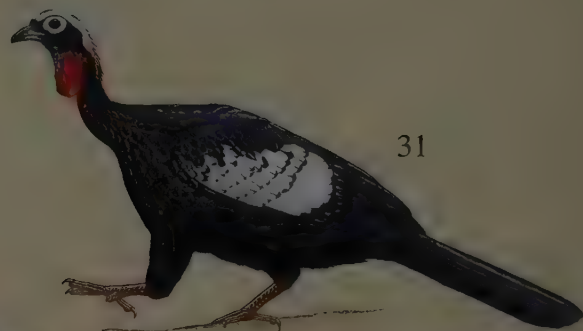
Breeding. No information available.

Movements. No information available, but presumably sedentary.

Status and Conservation. Not globally threatened. Currently considered near-threatened. Present at Raso da Catarina, NE Bahia, but considered scarce. Apparently still occurs in some densely populated areas and has been seen offered locally for sale. In 1988, was reckoned not to be rare overall, but under great pressure due to habitat loss and hunting. Uncommon in collections, but has been bred in Mexico and in Brazil.

Bibliography. Bronzini (1946), Collar & Andrew (1988), Eley (1979), Estudillo López (1983), Forrester (1993), Pinto (1964), Sick (1985a, 1993), Vaurie (1966b).

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30



Genus *PIPILE* Bonaparte, 1856

28. Trinidad Piping-guan

Pipile pipile

French: Pénélope siffleuse

German: Trinidadguan

Spanish: Pava de Trinidad

Taxonomy. *Crax pipile* Jacquin, 1784. Orinoco River near Cumaná; locality probably erroneous. All members of *Pipile* have been placed in genus *Aburria*, and previously even in *Penelope*. Present species forms superspecies with *P. cumanensis*, to which it is very closely related, and *P. cujubi*; all three often treated as conspecific; the more distinct *P. jacutinga* also sometimes included in the superspecies, or even in expanded species, making genus *Pipile* monospecific. Monotypic.

Distribution. Trinidad.



Descriptive notes. c. 69 cm. More brownish and less glossy than *P. cumanensis*, and with predominantly dark crest; gloss is purplish brown; breast has white markings faint or lacking.

Habitat. Remote primary forest in areas of minimal human disturbance; favours sites with sparse ground cover and closed canopy, rich in vines and epiphytes; lower montane rain forest in Northern Range and semi-evergreen seasonal forest in Southern Range; prefers steep hilly areas with deep valleys and abundant water courses, between 400 m and 900 m. Some records from second growth, coffee plantations and cultivated plots adjacent to primary forest.

Food and Feeding. Mainly fruits and seeds of trees including those of *Ocotea*, *Pouteria*, *Bursera*, *Didymopanax* and *Erythroxylum*; also of *Lantana* in second growth; young leaves and insects occasionally reported. Drinks from streams and forest epiphytes. Forages in small groups usually of up to 5 birds, although old records mention flocks of 12-15 birds; forages most often in the evening, extending 1-2 hours after dark (see page 323).

Breeding. Seems to have a protracted season; records of breeding activity in most months. Nest is stick platform usually located within tangle of vegetation. 2 eggs. No further information available.

Movements. Mainly sedentary, but in Northern Range birds move locally over large areas in search of fruit.

Status and Conservation. ENDANGERED. Situation serious; action urgent. CITES I. Formerly abundant and widely distributed, at least in N and S of island; relatively large numbers probably remained until 1940's or 1950's. Currently only two small, widely disjoint populations survive, one in the Northern Range and the other in the Southern Range. Total population roughly calculated to number c. 100 birds in 1980. Habitat loss and hunting pressure are causes of marked decline that species has undergone. Intensive timber extraction, conversion of forests into commercial timber plantations, and construction of access roads for agriculture (also bringing in settlers) continue to be main threats, along with tourism. Decline caused by hunting was already reported in 1894 and has continued until present day, despite legal protection of species since 1963; high levels of illegal hunting blamed for absence of species in accessible areas of Northern Range where ecological conditions seem to be ideal. Most of species' current range lies within reserves or state forests, but existing laws concerning hunting, settling and logging are not enforced. Conservation education campaigns about the species, the country's only endemic bird, were carried out throughout 1980's.

Bibliography. Belcher & Smoother (1934-1937), Collar *et al.* (1992), French (1969, 1973, 1992), Herklots (1961), James & Hislop (1988), Junge & Mees (1958), King (1978/79), Salvadori (1914), Vaurie (1967a).

29. Blue-throated Piping-guan

Pipile cumanensis

French: Pénélope à gorge bleue

German: Blaukehlguan

Spanish: Pava Goliazul

Other common names: Common Piping-guan; White-headed Piping-guan (*cumanensis*); Gray's Piping-guan (*grayi*)

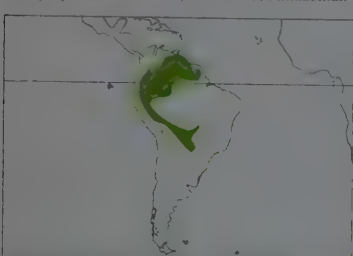
Taxonomy. *Crax cumanensis* Jacquin, 1784. Orinoco River region near Cumaná.

All members of *Pipile* have been placed in genus *Aburria*, and previously even in *Penelope*. Present species forms superspecies with *P. pipile*, to which it is very closely related, and *P. cujubi*; all these forms often treated as conspecific, with *P. pipile* as species name; some authors also include the more distinct *P. jacutinga*. Race *grayi* has been considered a separate species, but intergrades with nominate in SE Peru. *P. cujubi nattereri* has been considered race of present species, but is sympatric with *P. cumanensis grayi* in S Mato Grosso. Present species has hybridized with *Ortalis canicollis* in captivity. Two subspecies recognized.

Subspecies and Distribution.

P. c. cumanensis (Jacquin, 1784) - the Guianas, Venezuela S of R Orinoco, NW Brazil and Amazonian parts of C & E Colombia, E Ecuador and E Peru.

P. c. grayi (Pelzelin, 1870) - SE Peru, Amazonian NC & E Bolivia, SW Brazil and NE Paraguay.



Descriptive notes. 60-69 cm; 1200-1350 g. Blacker and glossier than *P. pipile*; glossy greenish blue (*cumanensis*) or greenish with only a few bluish tints (*grayi*). Colour of dewlap and bare facial skin varies considerably between white and cobalt blue. Race *grayi* has long, slender caruncle hanging from throat; white patch on nape more developed, and white patch on wing large and uniform.

Habitat. Humid *terra firme* and *várzea* forest, semi-deciduous forest, gallery forest and *cerrado* woodland, mainly in tropical zone. In the Guianas reaches coastal lowlands, as well as broken country inland. Many populations in

Amazonia are closely tied to riverine strips of forest within 100 m of the river, also tied to margins

of large rivers in French Guiana, and similar preference also noted in Colombia and Venezuela. Nominative race occurs up to 500 m in Colombia and 1000 m in Venezuela; race *grayi* recorded in subtropical forest, at over 2000 m in Bolivia; perhaps only enters this habitat in search of fruiting trees. In Paraguay apparently prefers wooded slopes of conical hills.

Food and Feeding. Shows preference for palm fruits; also recorded feeding on flowers of a *Tubatitia* tree; figs and snails have also been found in stomachs. When not nesting, forages in flocks of up to 15 birds, mainly in canopy or sub-canopy, rarely on ground. Visits salt-licks.

Breeding. In Peru, starts in Aug-Sept, with chicks in Jan-Mar; in Colombia, eggs in Feb and May; breeds during rains in areas with seasonal rains. Nest built of twigs, and placed in dense canopy vegetation. 3 eggs; incubation c. 24 days.

Movements. Presumably mainly sedentary. Possibly makes some altitudinal movements in search of fruiting trees. In Mato Grosso, Brazil, makes local movements up or down river.

Status and Conservation. Not globally threatened. Nominative race considered not uncommon in Surinam in 1968; evidently rare and very local in French Guiana, where considered vulnerable; considered local in Colombia and in Amazonas, Venezuela. Still common in Ecuador in undisturbed forests, with estimated density of 21-6 birds/km² in its preferred river edge forest habitat. In Peru, fairly common to common in S, but uncommon to rare in NE, where there is some danger of local extinction; preference for river edges and conspicuous habits have apparently rendered present species more vulnerable than other cracids of tropical forests. In Brazil, fairly common in N Roraima; scarce around cities of Tefé and Manaus, Amazonas; not recorded in recent times from Amapá. Race *grayi* common in entire Pantanal region of S Mato Grosso. Hunted for local food consumption, and locally for commercial purposes; also suffers in places from habitat destruction, mainly for agriculture. Nominative race quite common in captivity, where frequently bred; race *grayi* also present, and bred, in a few collections.

Bibliography. Belterman & de Boer (1990), Duhs (1992), Forester (1993), Haverschmidt (1968), Hernández & Rodríguez (1988), Hilly & Brown (1986), Johnson (1993), Meyer de Schauensee & Phelps (1978), Ortiz, E. & O'Neill (1988), Ortiz, E. (1981), Pinto (1938, 1964), Porras & Arriaga (1981), Remsen & Traylor (1989), Salvadori (1914), Sick (1985a, 1993), Snyder (1966), Strahl & Silva (1988), Thibault & Guyot (1988), Tostain *et al.* (1992), Traylor (1958), Vaurie (1967a), Willard *et al.* (1991).

30. Red-throated Piping-guan

Pipile cujubi

French: Pénélope cujubi

German: Rotkehlguan

Spanish: Pava Cuyubi

Other common names: Stripe-crowned Piping-guan (*cujubi*); White-headed/Natterer's Piping-guan (*nattereri*)

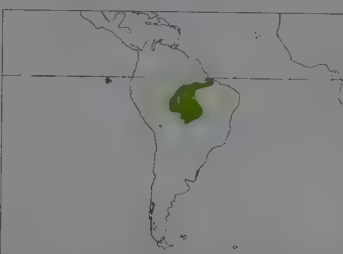
Taxonomy. *Penelope cujubi* Pelzelin, 1858. Pará.

All members of *Pipile* have been placed in genus *Aburria*, and previously even in *Penelope*. Present species forms superspecies with *P. pipile* and *P. cumanensis*, and all three often treated as conspecific, with *P. pipile* as species name; some authors also include the more distinct *P. jacutinga*, of which present species was in past considered race. Race *nattereri* has been considered a distinct species, or race of *P. cumanensis*, but sympatric with race *grayi* of latter in S Mato Grosso. Has hybridized in captivity with *Penelope supercilialis*. Two subspecies recognized.

Subspecies and Distribution.

P. c. cujubi (Pelzelin, 1858) - NC Brazil S of R Amazon, from lower R. Madeira to N Pará.

P. c. nattereri Reichenbach, 1862 - S & W Amazonia in W Brazil, up to border with Bolivia.



Descriptive notes. 69-76 cm; 1100-1300 g (*nattereri*). Nominative race has smaller areas of white on wing and crest, and usually has shorter dewlap than *nattereri*; also glossier, bluer plumage.

Habitat. Tropical forests, including riverine forests, in lowlands.

Food and Feeding. No information available on diet. Known to forage in flocks of up to 30 or more birds.

Breeding. No information available.

Movements. No information available, but presumably sedentary.

Status and Conservation. Not globally threatened. Nominative race fairly common in Amazônia National Park, Amazonas, and in parts of Rondônia; not recorded since at least 1960 around Belém and Santarém, Pará. Race *nattereri* fairly common to uncommon in N Mato Grosso, and probably also throughout most of range. Species very rare in captivity, but both subspecies present in one collection in Mexico.

Bibliography. Duhs (1992), Forester (1993), Hilly & Brown (1986), Pinto (1938, 1964), Remsen & Traylor (1989), Salvadori (1914), Sick (1985a, 1993), Vaurie (1967a).

31. Black-fronted Piping-guan

Pipile jacutinga

French: Pénélope à front noir

German: Schwarzmaskenguan

Spanish: Pava Yacutinga

Other common names: White-crested Piping-guan

Taxonomy. *Penelope jacutinga* Spix, 1825, between Bahia and Rio de Janeiro.

All members of *Pipile* have been placed in genus *Aburria*, and in past even in *Penelope*. Present species is most distinctive *Pipile*; has been considered to form superspecies with other members of genus, or even to be conspecific with them. *P. cujubi* was formerly considered race of present species. Range of present species meets *P. cumanensis* in E Paraguay, with no evidence of interbreeding. Monotypic.

Distribution. SE Brazil (S Bahia to Rio Grande do Sul), NE Argentina (Misiones and adjacent NE Corrientes) and SE Paraguay. Has disappeared from most of former range, and now very localized. **Descriptive notes.** 63-5-74 cm; 1100-1400 g. Only member of genus with black forehead, and with bare facial skin restricted to broad eye-ring. Chin and upper throat fully feathered. Large white wing patch with characteristic pattern produced by black tips of upperside-coverts. Juvenile similar to adult.

Habitat. Atlantic forest formations, including gallery forest, in lowlands and coastal ranges, up to 1850 m. Particularly favours forests rich in palmito (*Euterpe edulis*). Field work in several areas.



especially in Misiones, Argentina, show that species is very much tied to strips of forest close to streams or rivers, and is much rarer in forest interior.

Food and Feeding. Mainly fruits, especially those of palmito (*Euterpe edulis*); also of wild figs (*Ficus*), araçazeiros (*Psidium*), bicuiba (*Virola*), pindaúba (*Xylopia*), guarumo (*Cecropia*), *Hymaenea* and *Myrcia*. Seeds, grains and buds also recorded, and occasionally insects and even molluscs, which are taken among stones at side of a stream. Probably takes salt from mud. Forages alone, in pairs or in small groups; mainly in trees, but occasionally comes

to ground to take fallen fruits of e.g. *Virola*, or to drink; often forages in higher parts of emergent trees.

Breeding. Chicks in Oct (Misiones), Nov (Rio Grande do Sul). Nests found were platforms of twigs and stems, located on forks of trees. 2-3 eggs, perhaps up to 4; incubation c. 28 days. No further information available.

Movements. Altitudinal movements of birds inhabiting coastal ranges are known from several localities, mainly related to the availability of palmito fruit, which ripens earlier at lower altitudes. At any rate in past, some areas visited seasonally, e.g. Arroio Grande, Rio Grande do Sul, where species arrived in May-Jun and left in Dec, after nesting. Also used to appear in fair numbers in Santa Catarina during cold winters.

Status and Conservation. VULNERABLE/RARE. Populations only partly protected. CITES I. Formerly common or even abundant, at least seasonally; c. 50,000 birds killed in few weeks during cold winter of 1866 along lower R Itajaí, Santa Catarina. Since that period, species has declined markedly throughout range, and has virtually disappeared from N part; in S portion, now restricted to a few particular areas; migratory habits make its conservation in small areas difficult. In Brazil, fragmented populations small or very small; one of best occurs in Carlos Botelho State Park, São Paulo, where isolated birds or groups of 2-8 individuals observed 117 times between Jan 1985 and Sept 1986; long assumed to have disappeared from interior of São Paulo State, but one individual seen in Serra do Japi in 1988, although could have been an escaped bird; in 1986 reported from Miranda, Mato Grosso, extending known range to NW. In Paraguay currently uncommon, but suitable habitat remains in Alto Paraná and Canendiyú. In Argentina generally very rare, though locally commoner, e.g. in Uruguá-i Provincial Park, Misiones; also occurs in Iguazú National Park (55,000 ha), Misiones, where strict control led to slight increase in numbers between 1980 and 1985. Main cause of decline is habitat loss, through deforestation, hydro-electric developments and exploitation of palms within forests; in Argentina, its main food, palmito, has been overexploited to extinction. Hunting pressure also very important, and species long persecuted for feathers and food, causing local extinction at many sites, e.g. Sooretama Reserve, Espírito Santo; poaching is currently major cause of decline in several protected areas. Captive breeding achieved in several places. An undocumented attempt to reintroduce species in Sooretama Reserve failed.

Bibliography. Aguirre & Aldrichi (1983), de Almeida (1986), d'Angien (1988), Bege & Marterer (1991), Belton (1984), Canevari, M. *et al.* (1991), Canevari, P. & Caziani (1988), Chebez (1985, 1990), Coimbra-Filho & Magnanini (1968), Collar & Andrew (1988), Collar *et al.* (1992), Cominense *et al.* (1986), Dubs (1992), Gochfeld & Keith (1977), Gonzaga *et al.* (1987), Guix (1994), Guix *et al.* (1992), von Ihering (1885), King (1978/79), Nores & Yzurieta (1988), de Oliveira (1982), Paccanella *et al.* (1991), Pacheco & da Fonseca (1990), de la Peña (1992), Pinto (1951, 1964), Salvadori (1914), Scherer & Cominense (1981), Scott & Brooke (1985), Short (1971), Sick (1968, 1969, 1970, 1972, 1985a, 1993), Sick & Pabst (1968), Sick & Teixeira (1979), Sick *et al.* (1981), Straube (1988, 1990), Straube & Bomschein (1989), Taubel (1968), Teixeira & Antas (1981), Vaurie (1967a), Willis (1979).

Genus *ABURRIA* Reichenbach, 1853

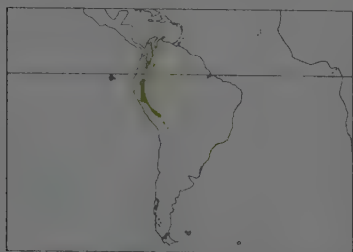
32. Wattled Guan

Aburria aburri

French: Pénélope aburri **German:** Lappenguan **Spanish:** Pava Aburria
Other common names: Wattled Piping-Guan

Taxonomy. *Penelope aburri* Lesson, 1828, temperate and cold lands in the mountains of New Grenada. Monotypic.

Distribution. W Venezuela and N Colombia S to SC Peru.



Descriptive notes. 72.5-77.5 cm; 1195-1550 g. Long, slender, bright yellow and red wattle hangs from throat, a feature unique to this species. Juvenile similar to adult, with less developed wattle.

Habitat. Wet mountain forest, borders of forest and tall second growth adjacent to primary forest. Mainly in subtropical zone, but also in hilly areas of upper tropical, pre-montane zone; sometimes, perhaps seasonally, ascends to lower limit of temperate zone. In Colombia occurs between 600 m and 2500 m, almost always in steep mountainous terrain; in Venezuela up to 1400 m; in Peru usually between

1000 m and 1900 m, with one record at 500 m and another at 2300 m. In Ecuador occurs only on the more humid E slope of the Andes and likewise in most of Peru, although has also been reported on W slope in Taulis, Cajamarca.

Food and Feeding. Fruit. Forages mainly between middle and upper storeys of fruiting trees, usually in pairs or groups of 3 birds.

Breeding. Sept-Mar in Peru; season considered to coincide with that of *Penelope barnata* in S Ecuador and N Peru, with chicks recorded Dec-Feb; in SW Colombia, most calling in Dec-Feb, and one adult with chicks in Mar. No further information available.

Movements. Presumably sedentary. Records of species in temperate zone have been attributed to possibly seasonal local movements.

Status and Conservation. Not globally threatened. Currently considered near-threatened. Threatened by loss of habitat over much of Colombian range, though considered numerous in 1986 in Cueva

de los Guácharos National Park, SW Colombia; status in Colombia classed as indeterminate in 1990. Local in Venezuelan part of range. In Peru, species may be seriously threatened, if not extinct, on W slope of Andes; on E slope is rare or has disappeared from around settlements, uncommon in large stretches of Hualallaga Valley due to habitat alteration for coca plantations, but still fairly common in other areas where forest is in good condition, e.g. in Jirillo, San Martín, and Coshipata, Cuzco. Its noisy habits and tendency to stay in branches when spotted make species particularly vulnerable to hunting; this, along with its relatively large size and good taste of its flesh, explains heavy persecution in many parts of range. Also suffers habitat destruction, as its altitudinal range coincides with an area where deforestation is especially frequent in the Andes. Taulis area in Peru should be urgently surveyed, to see if species survives on W slope of Andes in Peru; adequate protected areas should be established on both slopes in Peru, where species has not been recorded in any of existing protected areas. Very rare in captivity, but has been bred in one collection in Mexico.
Bibliography. Beebe (1947), Fjeldsá & Krabbe (1990), Hernández & Rodríguez (1988), Hilty & Brown (1986), Meyer de Schauensee & Phelps (1978), Ortiz, E. & O'Neill (1988), Ortiz, F. (1981), Ortiz, F. & Carrión (1991), Parker *et al.* (1982), Porras & Arriaga (1981), Strahl & Silva (1988), Traylor (1958), Vaurie (1967b).

Genus *CHAMAEPETES* Wagler, 1832

33. Black Guan

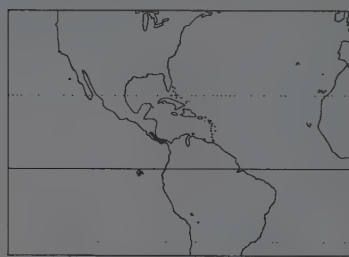
Chamaepetes unicolor

French: Pénélope unicolore **German:** Mohrenguan **Spanish:** Pava Negra
Other common names: Black Sickie-winged Guan

Taxonomy. *Chamaepetes unicolor* Salvin, 1867, Veragua.

Forms superspecies with *C. goudotii*. Monotypic.

Distribution. Mountains of Costa Rica and Panama.



Descriptive notes. 62-69 cm; c. 1135 g. Uniform black plumage; bare blue facial skin; red eyes. Juvenile similar to adult, but less glossy and with slightly browner underparts.

Habitat. Mountain cloud forest. Prefers steep terrain with ridges and ravines, but occasionally enters more open areas. Occurs in upper tropical, subtropical and temperate zones, up to 2500 m, near tree-line, in Panama; usually not below 1000 m, although one record at 450 m in Bocas del Toro, Panama.

Food and Feeding. Mainly fruits, including a wide range of types and sizes; in one study at Monteverde Cloud Forest Reserve, Costa Rica,

fruits of 26 species of plants were consumed, 11 of them commonly (*Beilschmiedia*, *Ocotea*, *Urera*, *Ardisia*, *Ilex*, *Guarea*, *Citharexylum*, *Guetarda*, *Chamaedorea*); in the same study, leaves of two species of *Asteraceae* were also taken, mainly during afternoon, while fruits were consumed at any time of day. Birds also seen taking fruits of guarumo trees (*Cecropia*). Seeds are defecated intact, and, as, unlike other smaller frugivores, present species rarely deposit seeds under parent plant, it seems to play an important dispersing role. Forages singly, in pairs or in small groups, mostly in trees; at times comes to ground, mainly to take fallen fruit.

Breeding. In Panama, young seen in Feb and Jun; pairing begins in Mar in Costa Rica, with very small chicks and almost full grown young being recorded at the same locality two days apart in Jul; this might suggest that replacement clutches can be laid. Lays 2-3 eggs; chicks have brown down, with a striped pattern on the head. No further information available.

Movements. Presumably sedentary, but no specific information available.

Status and Conservation. Not globally threatened. Currently considered near-threatened. In Costa Rica fairly common in several remote or protected areas, especially at Monteverde Cloud Forest Reserve, where a density of 4 pairs/km² was estimated at beginning of 1990's; scarce and wary where hunted. Reported as common in several areas of Panama during 1930's, but regarded as uncommon and very local in 1971; at that time extinction from Panama was already feared for near future if effective protective measures were not taken; in 1989 generally considered rare, but locally still moderately numerous. Much hunted for food. Very rare in captivity, but has been bred in one collection in Mexico.

Bibliography. Ridgely & Gwynne (1989), Ridgway & Friedmann (1946), Slud (1964), Stiles & Skutch (1989), Vaurie (1967b), Wenny (1993), Wetmore (1965), Wheelwright *et al.* (1984).

34. Sickie-winged Guan

Chamaepetes goudotii

French: Pénélope de Goudot **German:** Sichelguan **Spanish:** Pava Falcilar
Other common names: Goudot's/Rufous Sickie-winged Guan

Taxonomy. *Ortalia Goudotii* Lesson, 1828. Quindíu = Quindío region, Central Andes, Colombia. Forms superspecies with *C. unicolor*. Five subspecies recognized.

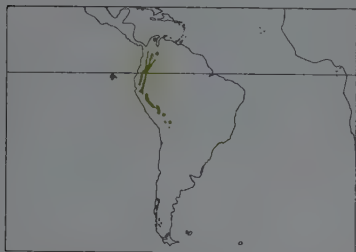
Subspecies and Distribution.

- C. g. goudotii* (Lesson, 1828) - Andes of C & W Colombia.
- C. g. sanctaemariae* Chapman, 1912 - Santa Marta Mts, N Colombia.
- C. g. jagani* Chubb, 1917 - W slope of Andes in SW Colombia and Ecuador.
- C. g. tsehudii* Taczanowski, 1886 - E slope of Andes in S Colombia, Ecuador and N Peru.
- C. g. rufiventris* (Tschudi, 1843) - E slope of Andes in C Peru.

In 1981 a new population was discovered in Departamento La Paz, Bolivia, and was said to represent a new, undescribed race; this was also interpreted as an indication that species has continuous distribution in appropriate habitat types from Colombia to C Bolivia, being easily overlooked due to its secretive habits, this possibly accounting for the apparent large gap in S portion of range.

Descriptive notes. 50-65 cm (races *tsehudii* and *rufiventris* largest); 550-800 g. Unmistakable combination of bright chestnut belly, pale blue facial skin and red eyes. Juvenile similar to adult, but duller. Races vary in size and tone of plumage coloration; race *rufiventris* has grey margins on neck feathers, producing scaly appearance.

Habitat. Humid and wet forests and forest borders of subtropical and, to lesser extent, lower temperate zones, on both slopes of Andes. In Colombia, mainly between 1100 m and 2500 m, but locally as high as 3000 m, e.g. in Santa Marta Mts, or as low as 500 m on Pacific slope. In Peru usually occurs



between 1500 m and 2500 m, but there are records at 900 m in Amazonas and at 3000 m in Puno. Newly discovered Bolivian population found at unusually high altitude of 3300 m. Mutual exclusion has been reported between present species and *Penelope montagnii*, with latter usually displaced to higher altitudes; but opposite occurs in Bolivia, at S extreme of range. Generally on steep hills with difficult access, mainly in zones of very high precipitation; prefers tall forest, but occasionally also recorded in second growth and lighter open woodland, like coffee plantations, at lower altitudes.

Food and Feeding. Mainly fruits, in 1-10 mm range; also seeds and leaves of several kinds. Despite repeated statements about mainly terrestrial habits, and occasional records of birds taking food from the ground, it seems that present species feeds mainly in fruiting trees, usually in middle storey or higher, in pairs or small groups of 3-5 birds, typically around dawn and dusk.

Breeding. Chicks recorded in Jun (Colombia), Sept (N Ecuador) and Feb-May (Peru). Chicks are chocolate brown above, with sooty black cap and throat, paler below.

Movements. Mainly sedentary. Performs some seasonal altitudinal movements, at least in parts of range. Records of birds descending to coffee plantations and second growth are always outside breeding season.

Status and Conservation. Not globally threatened. Currently suspected to be locally fairly common, and in Colombia is one of the few guans that can still be seen near or alongside roads in several areas; status in Colombia indeterminate in 1990. In Peru still common in some areas, although threatened locally; in the Huallaga Valley, threatened by forest destruction for coca plantations. Race *sanctaeamarthae* considered abundant in parts of the Santa Marta Mts in 1923; has declined and in 1990 classed as Indeterminate, probably at least vulnerable, by ICBP/IUCN International Cracidae Specialist Group. Habitat frequently altered in lower part of its altitudinal range; more secure at higher altitudes, due to inaccessibility. In contrast with other cracids, like *Aburria* and *Mitu*, quickly hides under cover when disturbed; this, together with its smaller size and rugged habitat, renders species less vulnerable to hunting; nevertheless, numbers have been much reduced around villages. Very rare in captivity, but has been bred in one collection in Mexico.

Bibliography. Cardiff & Remsen (1981), Fjeldså & Krabbe (1990), Hernández & Rodríguez (1988), Hilty & Brown (1986), Johnson & Hilty (1976), Ortiz, E. & O'Neill (1988), Ortiz, F. (1981), Parker *et al.* (1982), Remsen (1985), Remsen & Cardiff (1990), Remsen & Traylor (1983, 1989), Traylor (1958), Vaurie (1967b).

Bibliography. Alvarez del Toro (1981b), Andrie (1967b), Collar & Andrew (1988), Dickey & van Rossem (1938), Estudillo López (1983), Griscom (1932), Hoffmeister (1951), Land (1970), Leopold (1959), Mondragón & Baez (1981), Monroe (1968), Ortega & Aragón (1981), Ridgely & Gwynne (1989), Ridgely & Friedmann (1946), van Rossem (1934b), Rowley (1984), Saunders (1950), Vannini & Rockstroh (1988), Vaurie (1967b), Wetmore (1941), Zepeda (1981).

Genus *OREOPHYSIS* G. R. Gray, 1844

36. Horned Guan

Oreophasis derbianus

French: Oréophas cornu

German: Zapfenguan

Spanish: Pavón Cornudo

Other common names: Derby's Guan, Lord Derby's Mountain Pheasant

Taxonomy. *Oreophasis Derbianus* G. R. Gray, 1844, Guatemala.

This very distinct species has been considered intermediate between the guans and the curassows, sometimes separated in a tribe, or even subfamily, of its own (see page 311). Monotypic.

Distribution. SE Mexico (S Oaxaca and Chiapas) and Guatemala; there is also a probable record from Honduras, which remains unconfirmed.



Descriptive notes. 75-85 cm. Unmistakable. Sexes alike; formerly alleged differences now attributed to different ages of birds. Juvenile similar, but duller and with truncated horn.

Habitat. Humid evergreen mountain forest in subtropical zone, chiefly from 2300 m to 3100 m, occasionally as low as 1525 m, and very locally, in optimum habitat, up to 3350 m. Generally in areas with luxuriant undergrowth, with abundance of ground- and tree-ferns, epiphytes, mosses and creepers. Although the broad-leaved forest that species inhabits can be mixed with cypress or pine to some extent, species avoids drier slopes dominated by oak-

pine forest.

Food and Feeding. Mainly fruits and green leaves; studies at El Triunfo, Chiapas, have recorded the fruits of 37 plant species from 18 families (notably Lauraceae, Araliaceae and Liliaceae), the leaves of five others (*Anthurium*, *Eupatorium chiapense*, *Schistocarpus bicolor*, *Cobaea scandens* and an untraced species of Scrophulariaceae, known as "cola de caballo"); also both fruits and leaves of *Solanum*. Buds and shoots have also been mentioned by other authors, as have invertebrates, mainly Orthoptera and their larvae, although in the most recent studies species is described as strictly vegetarian, with even young being fed on regurgitated fruit and fragments of green leaves. Has been seen walking and scratching vigorously, although the claim that it feeds primarily on the ground is clearly unlikely. Sometimes drinks water trapped in bromeliads.

Breeding. In El Triunfo mainly in low rainfall months of Feb-Mar, so that when rains return, by May, young are already half-grown; in Volcán Tacaná, season starts in Jan or before. Probably polygynous; male may have access to 3-5 females during breeding season. Nest located very high in trees (one was at 16.5 m, another at 22 m), usually in vicinity of running water; there are some dubious records of nests placed on the ground; nest is a rudimentary structure made of dry leaves and roots of epiphytic and parasitic plants. Lays 2 eggs; incubation 34-36 days; chicks have a combination of pale and dark brownish grey down above, with a chestnut stripe on the head, and paler underparts. Sexual maturity appears to be reached at 4 years in males (in captivity), and perhaps at 1 year in females; the age of an incubating female in a nest found in the wild was estimated, by size and horn length, at 12-14 months.

Movements. No information available, but presumably sedentary.

Status and Conservation. VULNERABLE/RARE. Populations only partly protected. CITES I. Clearly reduced in numbers during the 20th century; a marked decline was already recognized in Guatemala during 1930's, with birds not found for many years at localities where they had formerly been common. Also known to have declined seriously in Mexico by 1960's. At end of 1970's, total population estimated at under 1000 birds. In contrast, species found in the mountains of S Oaxaca in 1989 and has also recently been discovered in Sierra de las Minas, E Guatemala, where still considered to be common according to local report; there are other areas within its range, especially with impassable terrain, where it probably still occurs; local inhabitants have reported "large birds with single red horns" at Cerro Volcán Pacayita Biological Reserve, Honduras. Extensive deforestation, mainly for farming and establishment of coffee plantations, and extending above 2000 m in some places, has been one of the main reasons for decline suffered in both Mexico and Guatemala; in W Guatemala this has halved the area of potential habitat for the species, formerly estimated at 6000 km²; marble mining is serious threat to populations in E Guatemala, as implies complete clearance of cloud forest. Hunting, mostly for food by coffee plantation workers, is also a severe threat, as species is very vulnerable due to its great size and tameness; this factor has already been blamed for local extinction of species in some areas. The species is also persecuted for illegal trade, as demonstrated by the presence of 20 individuals offered for sale in a market in Tapachula, Chiapas, in 1991; all were juveniles of c. 1 year old, probably captured on Volcán Tacaná. Locally, livestock grazing in forest undergrowth and military operations have also contributed to decline. The species is protected in Mexico and Guatemala, but hunting laws are not enforced in either country. Several reserves in Mexico and national parks in Guatemala hold the species; most important are El Triunfo Biosphere Reserve, Chiapas, in Mexico, and Lago de Atitlán National Park in Guatemala; in Guatemala, species may also occur in three private reserves. The creation of several additional protected areas is badly needed; the unprotected Volcán Tacaná, on the border between Mexico and Guatemala, which holds one of largest remaining populations, could be established as an international park. Kept in captivity in Tuxtla Gutiérrez Zoo, Chiapas, and in private collection of J. Estudillo, Mexico, where at least 15 birds had been raised successfully by 1992.

Bibliography. Alvarez del Toro (1976, 1981a, 1981b), Andrie (1967a, 1969a, 1969b), Anon. (1989b, 1991b), Baepler (1962), Binford (1989), Collar & Andrew (1988), Collar *et al.* (1992), Estudillo López (1979b, 1983, 1986), González-García (1984, 1988a, 1988b, 1988c, 1991, 1993a, 1993b, 1994), González-García & Bubb (1989), Griscom (1932), Howell & Webb (1992a), King (1978/79), LaBastille (1973), Land (1970), Leopold (1959), Ortega & Aragón (1981), Parker *et al.* (1976), Ramos (1985), Ridgely & Friedmann (1946), Salvin (1860), Saunders (1950), Vannini & Rockstroh (1988), Veblen (1976), Wagner (1953), Wall (1992), Wetmore (1941), Zepeda (1981).

Genus *PENELOPINA* Reichenbach, 1862

35. Highland Guan

Penelopina nigra

French: Pénélope pajuil

German: Schluchtenguan

Spanish: Pava Pajuil

Other common names: Black Chachalaca, Black Pajuil, Black Guan (!), Little Guan, Penelopina

Taxonomy. *Penelope niger* Fraser, 1850, Locality unknown, described from aviary specimens.

A very distinctive species, probably most closely related to *Chamaepetes* (see page 314). Two subspecies (*dickeyi*, *rufescens*) have been described on the basis of variation in the colour of the bare facial skin, but validity doubtful. Monotypic.

Distribution. S Mexico (Oaxaca and Chiapas) S to N Nicaragua.



Descriptive notes. 59-65 cm; 866-914 g. Marked sexual dimorphism, with female larger than male, profusely barred and lacking dewlap. Juvenile similar to adult female, but less distinctly patterned.

Habitat. Wet pre-montane and montane broad-leaved forests of subtropical and temperate zones, from 900 m to c. 3300 m. Prefers the most humid, most heavily forested, steepest slopes and ravines, but occasionally also present in drier pine-oak forests. Does not appear to utilize plantations, even where original canopy has been left for shade.

Food and Feeding. Berries and other fruits make up much of diet; some animal items have often been recorded, including a small mouse and a salamander. Forages singly, in pairs or in small groups of 3-4 birds, often in twilight. Comes down to feed on ground on occasion.

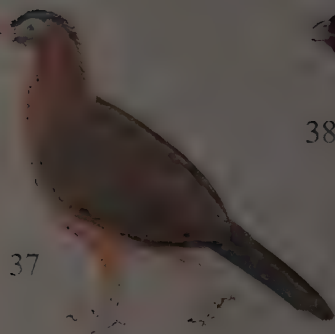
Breeding. Mar-May; chicks observed in Apr both in Guatemala and Oaxaca, Mexico. In a study in Guatemala, sex ratio apparently biased towards females, and polygyny is suspected. Nest is a fairly large, loose structure made of sticks and other plant material, lined with leaves and some of female's feathers, usually situated in trees 2.5-13 m high, occasionally nests in a depression on the ground. 2 eggs; chicks have black down mixed with buffy and brown.

Movements. No information available, but presumably sedentary.

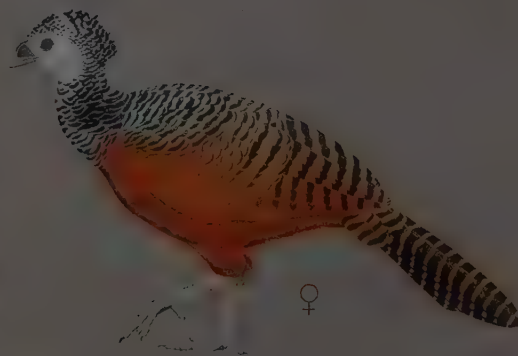
Status and Conservation. Not globally threatened. Currently considered near-threatened. Population has certainly been reduced as highland habitats of Central America have been altered. Encountered in moderate numbers in El Triunfo Biosphere Reserve, Chiapas; considered uncommon and local in Chimalapa region, Oaxaca, Mexico. Still locally common in areas of Guatemala, such as upper altitudes of Volcán Santa María, Volcán de Fuego, Volcán de Agua and the Atilán complex; readily observed at Biotopo Mario Dary, in Baja Verapaz. Considered uncommon and rather local in Honduras and N Nicaragua. In optimal regions it has recently been found that species can reach densities of 30 or more birds/km². Species may have been extirpated from El Salvador. Considered most endangered cracid in Nicaragua, due to extensive loss of its natural habitat. Apparent dependence on undisturbed, pristine forests renders it particularly vulnerable to habitat alteration. Locally threatened in Guatemala by marble quarrying operations, involving clearance of forests covering the mountain ridges, particularly in the Sierra de las Minas and the Sierra del Merendón. Very rare in captivity, but has been bred in one collection in Mexico. CITES III in Guatemala.

PLATE 33

inches 16
cm 40



43



barred morph

44



Subfamily CRACINAE

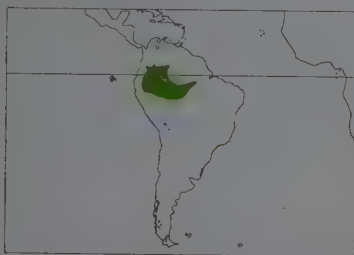
Genus *NOTHOCRAX* Burmeister, 1856

37. Nocturnal Curassow

Nothocrax urumutum

French: Hocco nocturne German: Rothokko Spanish: Paují Nocturno
Other common names: Rufous/Flat-crested/Urumutum Curassow, Urumutum

Taxonomy. *Crax urumutum* Spix, 1825, Rio Negro, Brazil. Formerly included, together with all other curassows, in *Crax*, but certainly distinct (see page 314). Most closely related to *Mitu*. Monotypic.
Distribution. Upper and middle Amazonia in S Venezuela, SE Colombia, E Ecuador, NE Peru and W & C Brazil.



Descriptive notes. 50-57.5 cm; one bird 1250 g. Unmistakable. Differs from all other curassows by smaller size and cryptic plumage in both sexes. Female similar to male, but has sides more heavily vermiculated. Juvenile very similar to adult.

Habitat. Dense humid forest, in *terra firme* forest and also permanently or seasonally flooded forests, usually near rivers. Apparently favours low-lying, partially flooded areas. Reported to occur in mature forest with flat or slightly undulating relief, generally below 800 m.

Food and Feeding. Forages, at least partially, during day-time, probably mainly around dawn and dusk. Forages singly, in pairs or in small parties; groups of 3-4 birds seen on ground under fruiting trees at dusk.

Breeding. Heard Oct and Jan-Feb and one female laying in Oct, in upper Rio Negro, Colombia. Monogamous, at any rate in captivity. Nest seems to be a rather large, loosely worked structure made of sticks, and placed in tree (one in a vine-covered tree, 4 m above ground), or on stumps or logs, not far above ground level. Lays 2 eggs; incubation 28-29 days (in captivity); chicks blackish brown above, buffy brown and white below. One female of unknown age died after being kept 16 years at Houston Zoo, Texas (USA).

Movements. No information available; presumably sedentary.
Status and Conservation. Not globally threatened. Status poorly known, but species probably reasonably secure, as parts of large range in W Amazonia are still in good condition. In Colombia reported to be numerous in Rio Guainía region and on Rio Vaupés at Caño Ti, W of Mitú, and thought possibly to be commoner in blackwater region of R Orinoco and R Negro than in S Amazonia. Considered common in Loreto, Peru, even at a distance of only 2 km from densely populated areas, e.g. along R Napo; population density estimated at 4-6 birds/km². Reported to be uncommon in Amazonas, Peru, apparently due to habitat destruction and conversion for agriculture. In Brazil, considered scarce in Rondônia; not recorded since at least 1960 from Pico da Neblina National Park, Amazonas. Its secretive habits may render species less vulnerable to hunting pressure; in some areas its call is frequently reported, where populations of other curassows have been severely devastated by hunters. Uncommon in collections but has been bred in a few, e.g. in USA (Texas), Mexico and Belgium.

Bibliography. Amadon (1979), Berry (1981), Estudillo López (1977), Hernández & Rodríguez (1988), Heyland (1970), Hilty & Brown (1986), Meyer de Schauensee & Phelps (1978), Ocampo (1981), Ortiz, E. & O'Neill (1988), Ortiz, F. (1981), Ortiz, F. & Carrión (1991), Parker *et al.* (1982), Pinto (1964), Porras & Arriaga (1981), Ruschi (1979), Sick (1970, 1985a, 1993), Strahl & Silva (1988), Tahel (1969b), Todd *et al.* (1992).

Genus *MITU* Lesson, 1831

38. Crestless Curassow

Mitu tomentosa

French: Hocco de Spix German: Samthokko Spanish: Paují Culicastaño
Other common names: Lesser Razor-billed Curassow

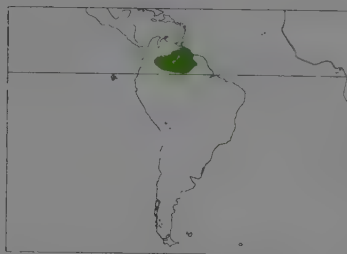
Taxonomy. *Crax tomentosa* Spix, 1825, "in Sylvius paludosis fl. Nigri prope pagum Barcellonam." All members of genus form superspecies; all have been placed, together with the members of *Pauxi*, and less often *Nothocrax*, in *Crax*. Range meets that of *M. salvini* in C Colombia, without any evidence of interbreeding. Monotypic.

Distribution. Guyana, Venezuela S of R Orinoco, NW Brazil and E Colombia.
Descriptive notes. 75-85 cm; male 2600-3050 g, female 2000-2450 g. Lacks crest and also any swelling on red bill. Combination of rich chestnut belly and tail tips characteristic.

Habitat. Rain forest, mainly along rivers; in Colombia, humid *terra firme* forest, especially along small streams. Also in gallery forest, e.g. in S llanos of Colombia and Venezuela. Partial to areas with thick undergrowth. In lowlands, up to 500 m in Colombia, to 600 m in Venezuela.

Food and Feeding. No information on diet. Forages singly or in pairs, mostly on ground, although said to spend more time in trees than other curassows.

Breeding. Probably begins with arrival of rains; 2 nests with eggs in Jun in Orinoco, Venezuela. Nest placed low in trees. Lays 2 eggs; chicks have blackish down above, dotted with buffy brown and pale grey, underparts much paler. Birds have survived more than 10 years in captivity.



ter (1985), Hernández & Rodríguez (1988), Hilty & Brown (1986), Meyer de Schauensee & Phelps (1978), Pinto (1935, 1964), Porras & Arriaga (1981), Scheuerman (1977), Schiffer (1989), Sick (1985a, 1993), Snyder (1966), Strahl & Silva (1988), Vaurie (1967d), Willard *et al.* (1991).

39. Salvin's Curassow

Mitu salvini

French: Hocco de Salvin German: Salvinhokko Spanish: Paují Culiblanco
Other common names: Salvin's Razor-billed Curassow

Taxonomy. *Mitua salvini* Reinhardt, 1879, no locality = eastern Ecuador. All members of genus form superspecies; all have been placed, together with the members of *Pauxi*, and less often *Nothocrax*, in *Crax*. Range meets that of *M. tomentosa* in C Colombia, without any evidence of interbreeding. Also reported to be marginally sympatric with *M. tuberosa* at some localities in Peru. Monotypic.

Distribution. SC Colombia, E Ecuador and NE Peru.



Descriptive notes. 75-89 cm. Bill deep and laterally compressed, but not massive. Well developed crest usually carried depressed. Only *Mitu* with white abdomen.

Habitat. Humid *terra firme* forest; apparently avoids flooded areas. Usually in primary forest with flat or slightly undulating relief; occurs in lowlands, up to 600 m in Colombia.

Food and Feeding. Mainly fallen fruits and seeds, but apparently has rather broad diet; leaves also taken; also seen scavenging animal remains, in Macarena Mts, Colombia. Forages singly, in pairs or small family groups, mainly on ground.

Breeding. In a study in the Macarena Mts birds seen to associate in pairs all year round, and appear to have overlapping home ranges with loose territoriality. Lays 2 eggs; chicks brownish above, much paler below. No further information available.

Movements. No information available; presumably sedentary.

Status and Conservation. Not globally threatened. Few records from Colombia, although apparently occurs regularly in areas well away from human settlements; fairly common in Macarena National Park. In Amazonian Ecuador, present throughout the region, but in low numbers: a density of 3.8 birds/km² has been estimated in *terra firme* forest with low hunting pressure, whereas in forest with moderate hunting levels a density of only 1.6 birds/km² was calculated. In Peru, has declined around settlements, and reported to be rare near Iquitos, but fairly common in other areas; disappeared from around a densely populated area along R Napo, but survives, with healthy densities, 10-20 km back from the river. Actively hunted for local food consumption, and recorded for sale at market in Iquitos. Habitat destruction significant only locally. Uncommon in captivity, but has been bred in a few collections.

Bibliography. Haffer (1985), Hernández & Rodríguez (1988), Hilty & Brown (1986), Johnson (1993), Olsson (1971), Ortiz, E. & O'Neill (1988), Ortiz, F. (1981), Ortiz, F. & Carrión (1991), Parker *et al.* (1982), Scheuerman (1977), Vaurie (1967d).

40. Razor-billed Curassow

Mitu tuberosa

French: Hocco tuberculé German: Amazonashokko Spanish: Paují Tuberoso
Other common names: Greater/Amazonian Razor-billed Curassow

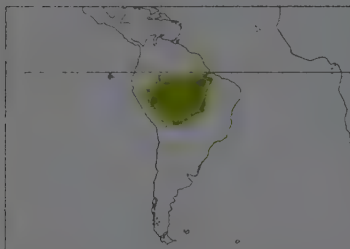
Taxonomy. *Mitu tuberosa* Spix, 1825, Rio Solimões, Brazil. All members of genus form superspecies; all have been placed, together with the members of *Pauxi*, and less often *Nothocrax*, in *Crax*. Often considered conspecific with *M. mitu* (see page 315). Has hybridized in captivity with several other species of curassow, including *Crax alberti*; at least some of these hybrids were fertile. Reported to be marginally sympatric with *M. salvini* at some localities in Peru. Monotypic.

Distribution. Amazonia, S of R Amazon, in extreme SE Colombia, Brazil, Peru and Bolivia.

Descriptive notes. 83-89 cm; up to 3860 g. Well developed crest usually carried depressed. Massive, casque-like bill. Juvenile similar to adult, but less glossy, with less highly developed crest.

Habitat. Forest, including humid *terra firme* forest, gallery forest, swampy areas in forests, smaller canopied forest streams and, at any rate in SE Peru, *várzea* forest. Usually in lowlands; occurs up to 300 m in Colombia, but recorded at 1340 m in Cordillera Vilcabamba, Peru.

Food and Feeding. Mainly fruits; also seeds and leaves; occasionally insects and other animals, including one caecilian (Gymnophiona) and frogspawn laid in small ponds. In one study in Cocha Cahu Biological Station, Manu National Park (Peru), 68 plant species were recorded as having been consumed; of fruits, those of *Pseudomedia*, *Clarisia racemosa* and *Leitonetea amazonica* were the most frequently taken; of leaves, several species of ferns (e.g. *Teactaria*, *Thelypteris*) were significant. Species forages singly, in pairs, or less often in groups of 3-5 birds, mainly on the



zônia (Tapajós) National Park, Pará; not recorded since at least 1960 from around the cities of Belém and Santarém, Pará. In Peru, reported to be common in areas with good forest, but rare or even extirpated near villages and major rivers; has disappeared from vicinity of a densely populated area on R Napo, but relatively common only 5-10 km from it; in Madre de Dios, reported to be present in disturbed areas if not hunted, even around populated zones, as long as there are dense thickets in which to hide; density of 16 individuals/km² estimated around Cocha Cashu Biological Station, Manu National Park. Particularly vulnerable to hunting, as tends to flee very noisily when alarmed, and to stop conspicuously on branches that lack any sort of cover. This, together with large size and much prized flesh, accounts for heavy persecution of species. Threatened locally by habitat destruction, e.g. in Huallaga Valley, NE Peru, for coca plantations. Quite common in captivity, where frequently bred.

Bibliography. de Boer & Belterman (1981), Dubs (1992), Forrester (1993), Haffer (1985), Heinroth (1931), Hernández & Rodríguez (1988), Hilty & Brown (1986), Koepcke & Koepcke (1963), Madariaga & Yarena de Vega (1981), O'Neill (1974), Ortiz & O'Neill (1988), Parker *et al.* (1982), Pinto (1935, 1964), Remsen & Traylor (1989), Rutgers & Norris (1970), Scheuerman (1977), Schifter (1989), Sick (1985a, 1993), Taibell (1969a), Terborgh (1986), Terborgh & Weske (1975), Todd *et al.* (1992), Torres (1989), Traylor (1958), Vaurie (1967d).

41. Alagoas Curassow

Mitu mitu

French: Hocco mitou

German: Mituhokko

Spanish: Paují de Alagoas

Taxonomy. *Crax Mitu* Linnaeus, 1766, Brazil and Guiana = north-eastern Brazil.

Mentioned by Marcgraf in 1648, its true existence was questioned for a long time until its rediscovery in 1951. All members of genus form superspecies; all have been placed, together with the members of *Pauxi*, and less often *Nothocrax*, in *Crax*. Often considered conspecific with *M. tuberosa* (see page 315). Monotypic.

Distribution. NE Brazilian coast, in recent decades only in Alagoas; formerly also in E Pernambuco; report of occurrence in N Bahia seems to be unreliable. Probably now extinct, or virtually so, in the wild.



1978 were feeding on fruits of *Eugenia*.

Breeding. One occupied nest found in Nov 1978 was situated in a tree, amidst thick foliage. Lays 2-3 eggs in captivity; downy chicks have upperparts rich orangish brown spotted with black, whitish throat and belly, and orangish brown breast. A captive-bred female laid her first clutch when 2 years old.

Movements. No information available, but presumably sedentary.

Status and Conservation. ENDANGERED. Situation critical: action urgent. CITES I. Discovered in early 17th century, then there was no further definite information about its existence until its rediscovery in 1951, at São Miguel dos Campos, Alagoas, where an adult female was collected. At that time, although species was fairly easily located, a rapid recent decline was evident. Assessments concluding species had probably become extinct were repeatedly made from about 1960 on, although fieldwork in the region showed that it was still extant, though with numbers extremely reduced, in 1960's and 1970's; the last known records correspond to an old bird killed by hunters in 1984, and another bird observed in 1987 and killed shortly afterwards. About 20 birds were estimated to survive in São Miguel dos Campos forests during 1960's; total population reckoned at less than 60 birds in 1986, but almost certainly far fewer birds survived, even if the captive population were included. Destruction of habitat has been main cause of disastrous decline; despite early warnings forecasting extinction of species, no effective action was taken to save it; cutting of forest proceeded, mainly for conversion to sugar cane plantations, and it was intensified during late 1970's in connection with a government programme to increase the production of fuel alcohol. Hunting pressure was also heavy, right from the time of the species' rediscovery, when a single hunter was reported to have killed many birds; this pressure demonstrated by last known records in the wild. Pesticides used in cane fields around the last forest patches may also have had detrimental effects. Attempts in 1983-1985 to capture birds for an official captive breeding programme failed, but breeding has been achieved regularly in the only captive population of the species, held since 1977 in the private collection of P. M. Nardelli in Nilópolis, Rio de Janeiro, and numbering 34 birds in 1993. This population, if suitably managed, holds the only chance of survival of the species, although reintroduction in the wild will be difficult, as virtually no adequate sites exist; only c. 800 ha of lowland forest remain in Alagoas, with an estimated capacity of some 32 pairs; protection and management of this area at São Miguel dos Campos, where a few individuals of the species may still persist, is in any case important for several other Neotropical endemics. See page 340.

Bibliography. Coimbra-Filho (1970, 1971), Collar & Andrew (1988), Collar *et al.* (1992), Estudillo López (1983), Haffer (1985), King (1978/79), Nardelli (1981, 1988, 1993), Pinto (1935, 1946, 1952b, 1954, 1964), Sick (1969, 1972, 1978, 1980, 1983, 1985a, 1993), Sick & Teixeira (1979), Teixeira (1986), Teixeira & Antas (1981), Vaurie (1967d).

ground; study in Cocha Cashu revealed that 95% of food was taken from ground, rest from trees and bushes at various different heights. Feeds near monkeys (*Cebus*, *Saimiri*), taking fruits that have fallen to the ground, before they decompose. Visits salt-licks.

Breeding. Nest placed in trees. Lays 2-3 eggs; incubation 30-32 days; chicks brownish above, whitish buff below. One male lived more than 23 years in captivity.

Movements. Presumably sedentary.

Status and Conservation. Not globally threatened. Considered fairly common in many parts of Brazilian range, including Ama-

Genus *PAUXI* Temminck, 1813

42. Northern Helmeted Curassow

Pauxi pauxi

French: Hocco à pierre

German: Helmhooko

Spanish: Paují de Yelmo

Other common names: Helmeted/Galateated Curassow

Taxonomy. *Crax pauxi* Linnaeus, 1766, Mexico, error = Venezuela.

Both members of genus have been placed, together with those of *Mitu*, and less often *Nothocrax*, in *Crax*. Forms superspecies with *P. unicornis*, which has been considered a race of present species (see page 315). Race *gilliardi* has sometimes been considered specifically distinct, but differences very slight. Two subspecies recognized.

Subspecies and Distribution.

P. p. pauxi (Linnaeus, 1766) - NC & W Venezuela through Andes of Mérida across border into northernmost E Andes of Colombia.

P. p. gilliardi Wetmore & Phelps, 1943 - Sierra de Perijá, occurring on both sides of Venezuelan-Colombian border.



Descriptive notes. 85-92 cm; male 3500-3750 g; one female 2650 g. Large, fig-shaped (nominate race) bluish grey casque on forehead. Normal morph female like male; barred (rufous) morph is uncommon. Juvenile similar to adult, but shows some brown vermiculations on underparts and has smaller casque. Races vary in shape of casque, which is smaller and less swollen in *gilliardi*.

Habitat. Dense, wet, cool montane forest (cloud forest) on steep slopes in subtropical zone; also ranges into adjacent parts of tropical and temperate zones. Prefers very dense cloud forest, mainly between 1000 m and

1500 m, but has been recorded from 500 m up to 2200 m. In the Venezuelan Coastal Range, seems to prefer windward, N slopes. Particularly favours humid gorges with thick undergrowth of dwarf palms and terrestrial aroids, although females tend to select somewhat drier places when nesting. Avoids forest borders.

Food and Feeding. Mainly fallen fruits and seeds, which are taken from ground; also tender leaves, grasses and buds of undergrowth plants. Seeds of fruits are regurgitated. Forages singly, in pairs, or in family parties, occasionally in groups of up to 6 birds or more, only during first hours of the day and late afternoon.

Breeding. Territorial singing begins with the onset of the rainy season, usually in Dec; nests built in Mar-Apr; one juvenile of race *gilliardi* in Aug. Nest is a simple structure made of branches, twigs and leaves, lined with a few leaves, placed in forks or horizontal branches of a tree 4-6 m above the ground. Lays 2 eggs; incubation c. 34 days (one record of 30 days in captivity). No further information available.

Movements. Mainly sedentary, but it has been suggested that species makes some altitudinal movements, possibly in search of food.

Status and Conservation. ENDANGERED. Situation serious: action urgent. Common during last century in mountains of N Venezuela: in 1875 a collector took more than 50 specimens in just a few weeks. Still fairly common during 1950's, although by this time was already extirpated from settled areas and scarce at Henri Pittier National Park, N Venezuela, which held an estimated population of only 25-50 birds. In 1987 species was said to suffer a drastic decline in N Venezuela, although it seems to occur at a naturally low level of abundance (5-10 birds/km²); current status in Andes of Mérida is unknown. In Colombia, nominate race was considered very rare in 1965, and there appears to be no subsequent information. No information on status of race *gilliardi* in either Colombia or Venezuela, but it is also believed to be under considerable pressure; however, its range might extend further S than is currently known. Causes of the severe decline of the species in N Venezuela have been deforestation and indiscriminate hunting (for food and, in the case of Indians, also for its casque, or "helmet", that is used in necklaces), factors that also occur in other parts of species' range. Occurs in two national parks in Colombia (El Cocuy and Tamá) and three in Venezuela (Guatopo, Yacambú and Henri Pittier), but at any rate in Venezuela it is still hunted and suffering human disturbance associated with roads; the establishment of an international national park in Sierra de Perijá has been suggested as an essential measure for the protection of race *gilliardi*. A major education campaign concerning the conservation of the species is being mounted for both Colombia and Venezuela and is already being implemented in parts of Venezuela. Uncommon in captivity, but has been bred in a few collections, including one in Mexico where both subspecies are reared. CITES III in Colombia.

Bibliography. Collar & Andrew (1988), Collar *et al.* (1992), Estudillo López (1983, 1986), Ginés & Avelado (1958), Glover (1977), Hernández & Rodríguez (1988), Hilty & Brown (1986), Madariaga & Yarena de Vega (1981), Meyer de Schauensee & Phelps (1978), Negret (1987), Nicéforo María (1955), Nicéforo María & Olivares (1965), Ocampo (1981), Phelps & Phelps (1962), Porras & Arriaga (1981), Schäfer (1953a, 1954a), Schäfer & Phelps (1954), Strahl & Silva (1987, 1988, 1989), Taylor (1975), Todd *et al.* (1992), Vaurie (1967d), Wetmore & Phelps (1943).

43. Southern Helmeted Curassow

Pauxi unicornis

French: Hocco unicomme

German: Hornhooko

Spanish: Paují Unicomio

Other common names: Horned Curassow, Bolivian Helmeted Curassow

Taxonomy. *Pauxi unicornis* Bond and Meyer de Schauensee, 1939, above Bolívar, near Palmar, Yungas de Cochabamba, Bolivia.

Both members of genus have been placed, together with those of *Mitu*, and less often *Nothocrax*, in *Crax*. Has been considered a race of *P. pauxi*, with which forms superspecies (see page 315). Two subspecies recognized.

Subspecies and Distribution.

P. u. unicornis Bond & Meyer de Schauensee, 1939 - E slope of Andes in C Bolivia.

P. u. koepckee Weske & Terborgh, 1971 - slopes of Cerros del Sira, E Peru.

In 1992 a bird of undetermined race was seen in Cerros de Távora, S Peru, half way between known ranges of the two subspecies; has hence been suggested that species may be present on low Andean foothills and outlying ridges from the Cerros del Sira S into Bolivian Yungas.



Descriptive notes. 85-95 cm; male c. 3850 g; female c. 3600 g. Separated from *P. paxi* by shape of casque, deeper bill and presence of short, tightly curled, glossy crest. Peruvian race *koepckeae* has shorter helmet tilted further back, and less white on tail tips.

Habitat. Dense lower montane forest, with heavy rainfall, usually in rugged hilly country, especially between 450 m and 1200 m. In Amboró National Park, EC Bolivia, birds were found in semi-open tropical forest on steep slopes; cliffs, banks and steep ridges may help birds to escape predators by gliding downhill.

Food and Feeding. Fallen nuts of "almendrillo" (almond tree) apparently constitute major food; hard shell disintegrates, allowing birds to get at seeds. Presumably also takes other fruits fallen from trees; three types of laurel (*Nectandra*) and "negrillo" (Lauraceae), reported as food by locals. Forages mainly from dawn to 08:30 h, and from 16:00 h to dusk, or later on moonlit nights; noted to be far more active on days following moonless nights.

Breeding. Activity (nuptial calls) begins with start of rains, in Sept, in Amboró National Park. Apparently polygynous (see page 328). Only one nest has been found to date, in Oct at the same locality: a substantial structure placed 5 m up in the fork of an isolated tree, containing only 1 egg; chick rich brown, marked with black above, buff and whitish below. On basis of casque sizes, it is believed that 1st year birds participate in courting and breeding.

Movements. Presumably sedentary, but in Amboró National Park some dispersive movements have been observed at end of breeding season.

Status and Conservation. VULNERABLE/RARE. Populations only partly protected. Exceptionally poorly known; species is considered rare in Bolivia and is likely to be equally rare in Peru; apparently, it is naturally rather local in distribution, and since its discovery has never been reported as common. In Bolivia, forests in its altitude zone are rapidly being cleared; the species is persecuted by professional hunters, who are to blame for decline in numbers; also by locals, mainly for food, but, in the Yungas of Totorá, also for its helmet, which is used as a fashionable cigarette-lighter; apparently, in the Amboró area, its skewered head is used in traditional dances. An increase in numbers of the species is believed to have taken place in Amboró National Park since 1987, apparently due to reduction in hunting pressure as a consequence of wardening improvement; an estimate of 40 birds in a 100 ha plot was made in 1988 through quantitative analysis of calling data. Nevertheless, lack of funds threatens to intensify already serious problem of staff shortages; incursions continue, especially in N of park, as access very difficult to restrict, due to presence of two major roads along boundaries of park; illegal timber extraction and burning of margins are steadily reducing extent of intact habitat, and park is shortly to be reduced in size, in response to these losses. Efficient protection of the habitat of this biologically rich protected area of 180,000 ha is essential for the long-term security of the species; encroachment by settlers must be terminated; funds required. In Peru, priority should be given to establishment of a protected area in the Cerros del Sira. Equally, fieldwork in border region should be carried out in order to reveal new populations of species. Captive breeding has been achieved in the private collection of J. Estudillo, in Mexico, where more than 10 birds were present in 1993.

Bibliography. Anon. (1989a), Collar & Andrew (1988), Collar *et al.* (1992), Cordier (1971), Cox (1990), Cox & Clarke (1988a, 1988b), Estudillo López (1983, 1986), Hardy (1984), Ortiz & O'Neill (1988), Parker *et al.* (1982), Remsen & Traylor (1989), Vaurie (1967d), Wennrich (1981), Weske & Terborgh (1971).

Genus CRAX Linnaeus, 1758

44. Great Curassow

Crax rubra

French: Grand Hocco **German:** Tuberkelhokko **Spanish:** Pavón Norteño
Other common names: Great Crested/Mexican/Globose Curassow; Cozumel Curassow (*griscomi*)

Taxonomy. *Crax rubra* Linnaeus, 1758, no locality.

All members of genus form superspecies. *C. globicera* is synonym. Bogus forms "*C. chapmani*" and "*C. hecki*" described from females of rare barred morph. Birds occurring S from S Nicaragua described as separate species, "*C. panamensis*", but not now accepted even as race. Taxonomic revision of populations required, especially in S of range, as undescribed races may be found.

Species has hybridized with *C. alberti* and *C. alector*, producing fertile offspring. Two subspecies recognized.

Subspecies and Distribution.

C. r. rubra Linnaeus, 1758 - E Mexico S through Central America to W Colombia and W Ecuador.
C. r. griscomi Nelson, 1926 - Cozumel I, on coast of Yucatán, SE Mexico.



Descriptive notes. Male 87-92 cm, 3600-4800 g; female 78-84 cm, 3100-4270 g. Crest very well developed; this and prominent knob on bill separate male of present species from *C. alector*, the only other *Crax* with uniform black tail and yellow cere. Unlike any other curassow, female has three morphs; barred morph rare; intermediates of the dark and red morphs may occur, as may those of the barred and dark morphs; dark and barred morphs unknown in South American part of range, while red morph does not occur in Mexico. Immature male at first similar to dark morph female, but darker; black adult plumage acquired long

before bird fully grown; immatures lack knob on bill. Immature females of all morphs similar to adults. Race *griscomi* smaller, with some slight colour differences in females.

Habitat. Heavy rain forest in tropical and lower subtropical zones; usually occurs in lowlands, but also in foothills up to altitudes of about 1200 m, sometimes higher, e.g. in Volcán Barú, Panama, where species has been recorded up to 1900 m. In Yucatán, Cozumel I and parts of Costa Rica also occurs in seasonally drier forest, although, unlike *Penelope purpurascens*, is absent from drier forests of W Mexico. Occasionally ventures into ravines, and, if unmolested, into partially cleared areas or even plantations.

Food and Feeding. Fruits, including figs and those of *Spondias*, *Chione* and *Casimira*; usually fruits fallen from trees and taken from ground, but sometimes also those hanging on trees, mainly in low branches, or shrubs; fruits can be eaten when hard and green. Occasionally takes leaves, and also some invertebrates and small vertebrates, which are found by gleaning foliage and litter. Forages singly, in pairs or in small groups of up to 6 birds. Drinks at edges of streams.

Breeding. Feb-May in Mexico, just before rains; Mar-May in Costa Rica; Feb-Mar in E Panama, during rains; two laying females in Mar in Chocó and NW Antioquia, Colombia. Monogamous. Nest is relatively small, flimsy structure made of sticks and lined with green leaves, placed in trees usually 3-6 m above ground; one nest was constructed entirely of green leaves. Lays 2 eggs; incubation c. 32 days; chicks greyish buff with black and chestnut markings above, whitish below. Long-lived; one female lived 24 years in captivity, and bred until 23.

Movements. Sedentary.

Status and Conservation. Not globally threatened. Rapidly disappears wherever logging roads are built into previously inaccessible forests; thus extirpated from much of Veracruz, Mexico. In Guatemala, still reported to be fairly common in E Caribbean lowlands, N Quiché and remote areas of Petén, but much reduced and threatened on Pacific slope, occurring in fragmented populations, particularly in Atitlán complex and S slopes of Volcanes Lacandón and Chiquibá. In El Salvador, species survives in El Imposible, a site proposed for protection. Maintains stable populations throughout vast areas in Nicaragua. In Costa Rica, now mostly scarce and local, with good populations persisting mainly in some national parks, including Santa Rosa, Rincón de la Vieja and Corcovado. In Panama, remains only in remote, uninhabited areas, where still seems to be fairly common, but disappears quickly, as settlement progresses; more widespread on Caribbean slope, while on Pacific slope seems to be limited to S Veraguas, W Azuero Peninsula, E Darien and some sectors of the canal zone, where very rare; in 1979 good numbers still occurred in Barro Colorado I Biological Reserve, where well protected, but apparently extirpated from Chiriquí region. In Colombia, persists only in remoter areas and along Pacific coast can not be seen near any roads. In 1986 species was feared completely eradicated from Ecuador, with no records from previous 30 years. Race *griscomi* may be near extinct; in 1965, said to survive, although sometimes hunted; a male was seen around 1990 by a researcher after months of searching. Nominate race quite common in captivity, where frequently bred; in Guatemala, small breeding programme initiated with aim of reintroducing species in areas where now extinct. One of cracids most commonly kept in captivity by locals: in Guatemala up to 100 live individuals, mainly young birds, estimated to be sold each year in local trade. CITES III in Guatemala, Costa Rica, Honduras and Colombia.

Bibliography. Alvarez del Toro (1981b), Buchholz (1991, 1992), Dickey & van Rossem (1938), Estudillo López (1986), González (1986), Griscom (1932), Haffer (1975), Heinroth (1931), Hernández & Rodríguez (1988), Hilty & Brown (1986), Honsinger (1931), Jones (1992), King (1978/79), Land (1970), Leopold (1959), Lowery & Dalquest (1951), Madariaga & Yarena de Vega (1981), Mondragón & Baez (1981), Monroe (1968), Ocampo (1981), Ortega & Aragón (1981), Ortiz (1981), Pocock (1909), Quinto (1981), Ridgely & Gwynne (1989), Ridgway & Friedmann (1946), Rutgers & Norris (1970), Saunders (1950), Schifter (1989), Sermeño (1986), Slud (1964), Smith (1966), Stiles & Skutch (1989), Sutton (1955), Taibel (1940, 1950, 1955, 1956), Todd *et al.* (1992), Vannini & Rockstroh (1988), Vaurie (1967c), Wetmore (1965), Weyer (1982), Zepeda (1981).

PLATE 34

inches 16
cm 40



45. Blue-billed Curassow

Crax alberti

French: Hocco d'Albert

German: Blaulappenhokko

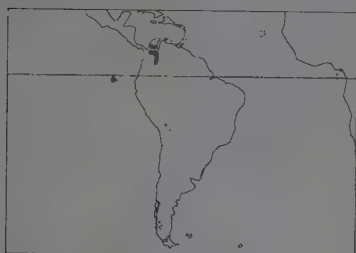
Spanish: Pavón Piquiazul

Other common names: Albert's/Prince Albert's/Colombian/Blue-knobbed Curassow

Taxonomy. *Crax Alberti* Fraser, 1850, based on a cage bird of unknown origin.

All members of genus form superspecies. Form "*C. annulata*" was described from a female of the rare barred morph and an immature male of present species. Form "*C. viridirostris*", with green cere, is thought to have been described from an abnormal specimen of present species or from a hybrid of present species with another species of *Crax* (see page 315). Has hybridized in captivity with *C. rubra* and *C. fasciolata*, producing birds with green cere; also with *C. globulosa*, *Penelope pileata* and *Mitu tuberosa*. Monotypic.

Distribution. N Colombia; currently survives only in a few remnant forest patches.



Descriptive notes. 82.5-92.5 cm. Only curassow with blue cere and wattles; male lacks knob on bill, having at most slight swelling. Rare barred morph of female has more white on crest, and breast and upper belly barred black and white; only recorded on N slope of Santa Marta Mts; another morph exists, intermediate between this and normal (rufous) morph.

Habitat. Humid forest in lowlands and foothills and on lower mountain slopes in tropical zone; occurs up to 1200 m, but commoner below 600 m.

Food and Feeding. No information available

on diet. Feeds mainly on ground.

Breeding. Young recorded in Jul in area of Santa Marta Mts; birds with enlarged gonads have been taken in Feb and Apr. No further information available.

Movements. No information available; presumably sedentary.

Status and Conservation. ENDANGERED. Situation critical: action urgent when population found. Although never known to be common, species has suffered a serious decline and is now believed to be extinct throughout most of its former range, probably with only a few small populations surviving, at unknown locations. There appear to be no records since 1978, when an observation was made at Puerto Berrio, Antioquia; in 1970's species was known to survive, although becoming very rare, in Serranía de San Jacinto, Bolívar; 4 birds, presumably taken from wild, were illegally imported to Japan from Colombia in 1987. Apparently extinct from Santa Marta region, where, in humid lowlands of N coast, species possibly reached its maximum abundance; a road now runs through this area. Deforestation and hunting have been main causes of species' decline. Rapid destruction of lowland forests noted throughout range of species during 1960's, mainly associated with agriculture; at that time forest was confined to ridges at Puerto Valdivia, while in 1970's it only remained along some of deep valleys in Serranía de San Jacinto. Hunting pressure very intense in 1940's in Santa Marta region, and this was probably true for whole range. No measures known to have been taken for conservation of species. Survey of major remaining areas of forest within species' range now being planned, in order to clarify current status and distribution. Small numbers of birds kept in captivity in a few collections; breeding has been successful in several of these; these birds could serve as stock for the development of a full-scale recovery plan. CITES III in Colombia.

Bibliography. Blake (1955), Collar & Andrew (1988), Collar *et al.* (1992), Darlington (1931), Estudillo López (1983, 1986), Hafler (1967, 1975), Hernández & Rodríguez (1988), Hilty & Brown (1986), King (1978/79), Negret (1987), Ocampo (1981), Schifter (1989), Serna (1980), Strahl (1991), Taibel (1950), Todd, W.E.C. & Carriker (1922), Todd, W.T. *et al.* (1992), Tokunaga (1987), Vaurie (1967c).

46. Yellow-knobbed Curassow

Crax daubentoni

French: Hocco de Daubenton

German: Gelblappenhokko

Spanish: Pavón Porí

Other common names: Daubenton's Curassow

Taxonomy. *Crax Daubentoni* G. R. Gray, 1867, "Central America"? = Venezuela.

All members of genus form superspecies. Form "*C. incommoda*" was described from a rather unusual female specimen of present species. Monotypic.

Distribution. N Venezuela (N of R Orinoco) and immediately adjacent parts of Colombia.



Descriptive notes. 84-92.5 cm; male 2925-3200 g, but one bird 1625 g; one female 2325 g. Male is only *Crax* with yellow cere that has prominent knob on bill and wattle, though latter less developed than former; white tips of outer rectrices also separate it from *C. alector* and male of *C. rubra*. Female quite similar to male but lacks yellow cere, and has white markings on crest and barred breast and upper belly; the only female *Crax* with dark cere and pure white abdomen. Juvenile male essentially like adult.

Habitat. Most commonly found in gallery forests of Venezuelan and Colombian llanos;

also occurs in foothills and broken country, especially in valleys or ravines with forest surrounded by drier deciduous woodland, e.g. in Perijá Mts; often near rivers. In llanos, during dry season birds gather by remaining water courses and water-holes. Recorded between 100 m and 500 m in Venezuela; between 500 m and 1500 m in Colombia.

Food and Feeding. No information available on diet. Forages from ground to tops of trees, in small family groups, or in flocks of up to 15 birds during dry season.

Breeding. Laying in Jun in Venezuelan llanos, during early rains; two females with eggs in May in Colombia; one juvenile in Aug on W slope of Perijá Mts, Colombia. Territorial, apparently with polygynous mating system. One nest placed in a tree. Lays 2 eggs.

Movements. No information available; presumably sedentary.

Status and Conservation. Not globally threatened. Is, or was, common in llanos, at least in Venezuela, and continues to be relatively plentiful in some areas, although declining due to extensive conversion of forest to rice fields in many parts of llanos; locally distributed in rest of range. In Colombia, known only from a few scattered localities. Receives protection on several cattle ranches, e.g. Hato Piñero and Hato Masaguaral. Uncommon in collections, but has been bred in captivity. CITES III in Colombia.

Bibliography. Buchholz (1989, 1990, 1991, 1992), Hernández & Rodríguez (1988), Hilty & Brown (1986), Jones (1992), Meyer de Schauensee & Phelps (1978), Porras & Arriaga (1981), Schifter (1989), Strahl & Silva (1988, 1989), Strahl *et al.* (1988), Todd *et al.* (1992), Vaurie (1967c).

47. Black Curassow

Crax alector

French: Hocco alector

German: Glattschnabelhokko

Spanish: Pavón Guayanés

Other common names: Crested/Smooth-billed Curassow

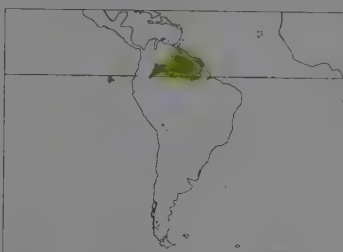
Taxonomy. *Crax Alector* Linnaeus, 1766, "America calidiore".

All members of genus form superspecies. *C. nigra* is a synonym. Has hybridized in captivity with *C. rubra*. Race *erythronatha*, described on basis of cere colour, not unanimously accepted; birds from extreme E Venezuela are intermediates, showing rich yellow bill with some orange shading; also, in Macarena Mts, Colombia, well into range of *erythronatha*, birds have orange-yellow instead of red, bill. Two subspecies usually recognized.

Subspecies and Distribution.

C. a. erythronatha P. L. Sclater & Salvin, 1877 - E Colombia and Venezuela S of R Orinoco, except extreme E.

C. a. alector Linnaeus, 1766 - extreme E Venezuela, the Guianas and N Brazil N of R Amazon.



Descriptive notes. 85-95 cm; male 2850-3750 g; female 2400-3425 g. Crest shorter and less dense than in other species of *Crax*. Essentially lacks bill knob and wattles, with at most slightly swollen cere. Bill more slender and appears longer than in other curassows. Tail uniform black in both sexes. Only species of genus in which female is almost identical to male, but former has a few narrow white bars on crest. Races separated by cere colour.

Habitat. Humid terra firme forest and gallery forest, favouring thickets along rivers and tangled forest borders; often ventures into areas with some clearings or open ground, e.g.

along roads or in old plantations. In French Guiana, occurs in primary forest, mainly in well drained ground of inland hills. In lowlands and foothills, locally up to 1700 m.

Food and Feeding. Mainly fruits (96-51% in one study in French Guiana); also some leaves, buds and shoots (2-83% together); invertebrates, especially Coleoptera, Dictyoptera and Hymenoptera (0-33%); flowers (0-30%); and mushrooms (0-03%). In French Guiana, fruits of 80 plant species have been identified, the most important quantitatively being those of *Eugenia coffeifolia* (15-1%, dry weight), *Guarea grandifolia* (12-1%), *Guarea kunthiana* (10-7%), *Bactris acanthocarpoides* (6-9%) and *Guarea gomma* (5-9%). Forages mainly on ground, singly or in pairs. Occasionally recorded foraging alongside Grey-winged Trumpeters (*Psophia crepitans*).

Breeding. Dec-Apr, during rainy season, in Surinam; records of young in Mar and Sept in French Guiana; one female in breeding condition in Jan in Macarena Mts, Colombia. Nest is loose structure of sticks; one was a rather small platform made of good-sized sticks, lined with leaves and small pieces of bark, placed in tree c. 5 m above ground. Lays 2 eggs.

Movements. Presumably sedentary.

Status and Conservation. Not globally threatened. In Colombia common, at least formerly, along E base of E Andes and in Macarena Mts; at latter locality, was considered most abundant large bird on slopes and summits of mountains, with estimate of 1 bird/c. 1-25 ha of forest. In Surinam, reported to be rather common in 1968. In French Guiana, considered at risk of extinction in medium term if strict protection measures not taken; along with Agami Heron (*Agamia agami*), reckoned to be one of the first species to disappear in areas subjected to heavy hunting pressure; has almost vanished in forests near the coast, around settled areas along large rivers, around inland villages, and wherever hunting pressure is high; optimal densities (over 8 birds/100 ha) only persist in S of country. In Brazil, fairly common in Amapá, northern Roraima and around Manaus, Amazonas; also in Pico da Neblina National Park, Amazonas, while in adjacent Cerro de la Neblina, Venezuela, was considered much less common than *Mitu tomentosa* in 1991. Quite common in captivity, where frequently bred.

Bibliography. Éard & Sabatier (1988), Éard *et al.* (1991), Forrester (1993), Glover (1977), Haverschmidt (1955, 1968), Hernández & Rodríguez (1988), Hilty & Brown (1986), Meyer de Schauensee & Phelps (1978), Pinto (1935, 1964), Porras & Arriaga (1981), Reinhard (1989), Schifter (1989), Siek (1985a, 1993), Snyder (1966), Strahl & Silva (1988), Thibault & Guyot (1988), Thiollay (1989a), Todd *et al.* (1992), Tostain *et al.* (1992), Vaurie (1967c), Willard *et al.* (1991).

48. Wattled Curassow

Crax globulosa

French: Hocco globuleux

German: Karunkelhokko

Spanish: Pavón Carunculado

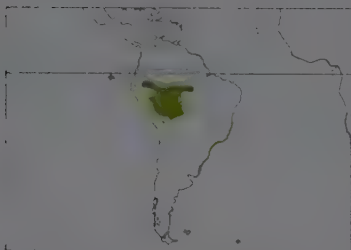
Other common names: Yarell's/Globulose Curassow

Taxonomy. *Crax globulosa* Spix, 1825, Rio Solimes, Brazil.

All members of genus form superspecies. *C. carunculata* and *C. yarellii* are synonyms. A close relationship has been claimed between present species and *C. blumenbachii*, especially because of very similar plumage of males; but voice very different, indicating that they are not conspecific. Has hybridized in captivity with *C. alberti*. Monotypic.

Distribution. Amazon basin in Brazil, SE Colombia, E Ecuador, E Peru and N Bolivia; range very incompletely known.

Descriptive notes. 82-89 cm; c. 2500 g. Male distinguished from that of *C. blumenbachii* by larger, very well developed wattles and, especially, bill knob; also has shorter crest. Knob and wattles



sometimes yellowish, but such birds separable from male *C. daubentoni* by uniformly black tail. Female is only *Crax* with red cere and rufous belly; some individuals may show marbled pattern wings, very similar to that found in *C. blumenbachii*. Juvenile similar to adult. **Habitat.** Humid forest of the lowland lowlands, occurring up to 300 m. Despite report claiming that species prefers drier areas within its habitat and avoids swamps, everything seems to indicate an association with water, and species has been found in *várzea*, river island forest, near streams and rivers of black water, and near edges of lakes or pools. Reports from

hunters on R Jurúá, Brazil, indicate that species primarily occupies *várzea* forest at least during most of year, while sympatric *Mitu tuberosa* uses both *várzea* and *terra firme* forest. Appears to be more arboreal than other curassows.

Food and Feeding. No information available about diet. Apparently feeds less on ground than other curassow species.

Breeding. Virtually no information from the wild. Two birds captured on Ilhas Codajás, Solimes, Brazil, had enlarged gonads in Jul and Aug. Lays 2 eggs (in captivity); chicks brownish above, whitish buff below. In captivity a female laid at 1 year old, but eggs smaller than normal and did not hatch. One bird lived more than 20 years in captivity.

Movements. No information available.

Status and Conservation. INDETERMINATE. Conflicting evidence, action may be urgently required. Although very poorly known, species appears to have declined markedly and suffered widespread local extinctions. Report describing species as abundant on lower R Beni, N Bolivia, during 19th century is not reliable, as collector supposed that *C. globulosa* and *Mitu tuberosa* were different aged individuals of same species; nevertheless, old records greatly outnumber recent ones. Local people in a number of areas throughout species' range in Peru, Ecuador and Brazil talk of species having disappeared completely, or almost, mainly since 1960's; also seems to have become extinct along R Caquetá, Colombia, and no records from E Ecuador since 1982, despite much recent ornithological fieldwork in the area; intensive survey in early 1990's, including numerous interviews with local hunters throughout region, indicates species probably extirpated from Ecuador. Some birds, mostly of unknown origin, kept in captivity; traders state that birds were still obtained from local people during 1980's from remote areas of Bolivia, S Colombia, W Brazil and NE Peru. Species recently reported from along R Jurúá, Brazil, by hunters, who describe it as far rarer than *Mitu tuberosa*, but still regularly encountered; apparently also recently recorded in SE Colombia. Large number of apparently unexplored and undisturbed rivers within potentially enormous range of species suggests populations could be found in new areas. Precise reasons for extreme scarcity of recent records remain unclear, despite known problem of intense hunting pressure, with exploitation for food and for bird trade, and also reported destruction of areas of *várzea* forest in Brazilian Amazonia and alteration of riverine habitats elsewhere. No measures for conservation in wild known to have been taken; despite evident rarity, species not protected under Brazilian law; not reported from any protected area throughout range. Paradoxically, one of curassows most frequently kept in captivity; breeding achieved in a few zoos and collections. CITES III in Colombia.

Bibliography. Blake (1955), Clarke (1965), Collar & Andrew (1988), Collar *et al.* (1992), Gyldestolpe (1945, 1951), Hernández & Rodríguez (1988), Hilty & Brown (1986), Johnson (1993), Koeppke & Koeppke (1963), Novaes (1978), Ortiz, E. & O'Neill (1988), Ortiz, F. (1981), Parker *et al.* (1982), Pinto (1935, 1964), Remsen & Traylor (1989), Schifter (1989), Sick (1985a, 1993), Strahl (1991), Teixeira & Sick (1981, 1986), Todd *et al.* (1992), Vaurie (1967c).

49. Bare-faced Curassow

Crax fasciolata

French: Hocco à face nue **German:** Nachtgesichtshokko **Spanish:** Pavón Muiú
Other common names: Banded/Slater's/Fasciated Curassow; Natterer's Curassow (*pinima*)

Taxonomy. *Crax fasciolata* Spix, 1825, state of Pará, Brazil.

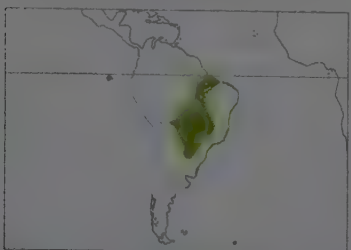
All members of genus form superspecies. *C. sclateri* is a synonym. "*C. estudilloi*", an unconfirmed new species described in 1977, is thought by some to have originated from a hybrid of present species with another species of *Crax* (see page 315). Present species has hybridized in captivity with *C. alberti* and members of *Penelope*. Recently, a new race, *xavieri*, described from a male of captive origin showing ochre flanks and upper thighs; possibly a plumage aberration. Three subspecies normally recognized.

Subspecies and Distribution.

C. f. pinima Pelzeln, 1870 - NE Brazil.

C. f. fasciolata Spix, 1825 - C & SW Brazil (S of R Amazon), Paraguay and N Argentina.

C. f. grayi Ogilvie-Grant, 1893 - E Bolivia.



Descriptive notes. Male 77-85 cm, 2700-2800 g; female c. 75 cm, 2200-2700 g. Only member of *Crax* with (black) bare skin around eye. Males of all three races rather similar: yellow cere with only incipient knob and without wattles, but appearing more robust than in *C. alector*; outer rectrices narrowly tipped white; some males of race *grayi* have very pale buff belly. Females of the three races vary markedly in extent of barring on upperparts, tail, breast and upper belly, and also in tone of underparts; amount of white in crest of *grayi* apparently shows considerable individual variation. Immature male similar to adult,

but with some yellow on bare skin below eye.

Habitat. Humid, semi-deciduous and gallery forests. Often recorded in woodland edges. Sometimes wanders along highways, mainly in early morning or late evening.

Food and Feeding. Fruits, usually fallen from trees and taken on the ground; also seeds and flowers; recorded feeding on the flowers of a *Tabebuia* tree. Visits salt-licks to take salt-rich earth. Forages singly or in pairs.

Breeding. Chicks in Dec. in Paraguay. Nest is a platform made of sticks, twigs, stems and leaves, lined with leaves, located in a tree; one was 4 m above ground, hidden in a tangle of creepers. Lays 2 eggs. Incubation c. 30 days.

Movements. Non-migratory in Pantanal of Mato Grosso, and probably throughout range.

Status and Conservation. Not globally threatened. Extirpated from parts of former range as result of habitat destruction and hunting. Race *pinima* considered nearly extinct in early 1970's, but still seen in reasonable numbers in forests of Rio Pindaré, Maranhão, in 1977, and in Quirém, E Pará, in 1978; recently found to be scarce around Belém, Pará; in 1990 still considered Endangered by ICBP/IUCN International Cracidae Specialist Group. Race *grayi* said to occur in fairly good numbers in Bolivia in 1986. Nominate race still relatively common in parts of Brazilian range, including Pantanal of Mato Grosso and Das Emas, Brasília and Araguaia National Parks; extinct in São Paulo. Considered rare and threatened in Argentina, except perhaps in E Formosa; known to occur in Guaycole Reserve, where in 1980's guards saw the species from time to time and 3 birds were kept captive; also present, but rare, in Reserva El Bagual (Presidente Irigoyen); apparently was also common in Misiones at end of 19th century, but rather rare or scarce during 1950's; in 1959 one bird was captured in Arroyo Uruguay-i, the only specimen taken by W. H. Partridge during 13 years of collecting in Misiones; only recent record is of a single bird observed in 1986 in Arroyo Uruzu, affluent of Arroyo Uruguay-i; possibly extinct in Santa Fé, where recorded in 1957. Only cracid in Argentina not known to occur in national parks; appears on bird list of Iguazú National Park, Misiones, but there are no documented records to support this. Locally kept in captivity. Nominate race is the most commonly kept *Crax* in collections, where frequently bred; races *grayi* and *pinima* much rarer in captivity, but both bred in private collections in Brazil and Mexico.

Bibliography. Allen *et al.* (1977), Bronzini (1943), Canevari & Cazzani (1988), Chebez (1987), Coupe (1966), Dubs (1992), Estudillo López (1986), Faust & Faust (1963), Forrester (1993), Guimarães *et al.* (1935), King (1978/79), Nardelli (1993), Navas & Bó (1988), Norez & Yzurietta (1988), Novaes (1978), de la Peña (1979, 1992), Pereyra (1950), Pinto (1935, 1964), Reinhard (1989), Remsen & Traylor (1989), Rutgers & Norris (1970), Schifter (1989), Short (1975), Sick (1969, 1979, 1985a, 1993), Straube & Bornschein (1989), Teixeira & Antas (1981), Todd *et al.* (1992), Vaurie (1967c).

50. Red-billed Curassow

Crax blumenbachii

French: Hocco de Blumenbach **German:** Rotschnabelhokko **Spanish:** Pavón Piquirrojo
Other common names: Blumenbach's/Red-wattled Curassow

Taxonomy. *Crax blumenbachii* Spix, 1825, state of Rio de Janeiro.

All members of genus form superspecies. In past, the sexes were thought to constitute two different species; male was described as "*C. rubristris*". A close relationship has been claimed between present species and *C. globulosa*, especially because of very similar plumage of males; but voice very different and precludes the possibility of their being conspecific. Monotypic.

Distribution. SE Brazil. Formerly fairly widespread from S Bahia S to NE Rio de Janeiro; currently restricted to a few scattered forest patches. One record from Bolivia repeatedly claimed to refer to present species, but erroneously.



Descriptive notes. c. 84 cm; c. 3500 g. Male has low knob on bill, but well developed wattles; crest longer than that of *C. globulosa*. Iris of adult male chestnut, of female orange-red. Female is only *Crax* that normally has wings finely barred or mottled black and chestnut, although pattern very variable individually; some females of *C. globulosa* may also show this character, but still separable, as female of present species has dark, rather than red, cere. Juvenile as adult, even before reaching same size, but crest appears higher in both sexes, as feathers less curved.

Habitat. Tall, humid primary forest, with rich undergrowth; also visits areas with lower vegetation, e.g. banks of large rivers, small floodplains, steep banks, forest tracks, treefalls and dense second-growth forest; may favour proximity of water. Occurs in lowlands, up to c. 500 m.

Food and Feeding. Fruits, usually fallen from trees and taken on the ground, but also picked off bushes and trees. Fruits can be hard and green or ripe; range from small, like berries, to so large that they must be pulled off branches and pecked to pieces once on the ground. Fruit species recorded include bicuíba (*Virola*), sapacaiá (*Lecythis*), murici (*Byrsonima*), aricanga palm (*Geonoma*), Byrbiçuba, *Eugenia*, *Ferdinandusa*, *Eschweilera* and *Pithecellobium*. Also takes tender leaves, seeds and buds, and occasionally some invertebrates, e.g. insects, centipedes and spiders (*Lycosa*). Drinks regularly, either from nearby watering places, including fresh puddles on tracks, or by taking water dripping from leaves after showers. Usually forages in pairs or in family groups up to 4 birds.

Breeding. Apparent variation in laying date from year to year, probably due to an extended breeding season each year; chicks recorded in Oct, Jan and Feb. Apparently polygamous, although the sex ratio may be affected by hunting. Nest is platform of twigs and sticks, placed in a tree between 2-6 m above ground level; an old record of a nest constructed on the ground is dubious. Usually 2 eggs, sometimes only 1; incubation 28 days. Sexual maturity reached at 2-3 years by female, which remains fertile for at least 11 years.

Movements. No information available; presumably sedentary.

Status and Conservation. RARE. Populations largely protected, but vigilance needed. CITES I. Seems to have been relatively common, at least in Espírito Santo and Bahia, during early 19th century, but in 1856 already noted as scarce in well settled areas; since then has continued to decline, so that is currently known to survive only in six or seven forest patches, with a total population guessed at a few hundred individuals at the most. Chief strongholds for the species are the Sooretama Biological Reserve and the adjacent reserve of Companhia Vale do Rio Doce, Linhares, in Espírito Santo; on the former a minimum of 26 birds were seen over period of three weeks in 1980-1981, suggesting a population of considerably more than the 60 birds supposed to occur there in 1977; in the latter 25 birds were recorded during a two week survey in 1985, and managers of the reserve believe that over 100 birds exist. No population estimates available from the three other protected areas holding the species (Monte Pascoal National Park and Una Biological Reserve, in Bahia, and Rio Doce State Park, in Minas Gerais), but numbers are likely to be very small. Has almost certainly disappeared recently from several reserves in Espírito Santo, including Fazenda São Joaquim (also known as Fazenda Klabin, now converted to the Córrego Grande Biological Reserve) where population estimated at c. 10 birds in mid-1970's; three quarters of forest remaining there at that time had been cleared by 1986. The clearance of forest at São Fidélis in 1963 led to the extinction of the species in the state of Rio de Janeiro, where it was first described. However, very recent survey work has turned up other, hitherto unknown, relict populations; at least according to local report, in unprotected forest patches (3000-5000 ha) near Camamu

and Teixeira de Freitas, Bahia. The causes of the serious decline suffered by the species are the severe forest destruction occurring throughout E Brazil and the extensive penetration of hunters and trappers into all of remaining habitat; trade has also been an enduring threat, with reports of capture in several protected areas, including Sooretama, during 1980's. Species is succesfully bred in captivity in several zoos and collections, especially in Fundação Crax, Minas Gerais, supported by Stichting Crax; this centre, which also keeps an international studbook for the species, held 258 birds in 1991, including 45 breeding pairs; 15 pairs from this stock were introduced into the Caratinga Reserve (Fazenda Montes Claros) in 1990, and another 15 into the CENIBRA Reserve, at Ipatinga, also in Minas Gerais, in 1991, although these areas may not have held the species

formerly; it is not known if the released stock in the Caratinga Reserve has survived, but c. 20 of the 30 individuals released into the CENIBRA Reserve were alive and well in 1993, and a second release of 37 birds was being prepared for the end of that year.

Bibliography. Aguirre (1947), Aleixo *et al.* (1991), Anon. (1991a), Coimbra-Filho & Magnanini (1968), Collar (1986b), Collar & Andrew (1988), Collar & Gonzaga (1988), Collar, Gonzaga, Jones & Scott (1987), Collar, Gonzaga, Krabbe *et al.* (1992), Estudillo López (1986), Euler (1968), Gochfeld & Kerth (1977), Gonzaga *et al.* (1987), King (1978/79), Pinio (1935, 1952a, 1964), Redford (1989), Scheres (1993), Scott & Brooke (1985), Sick (1969, 1970, 1972, 1983, 1985a, 1993), Sick & Pabst (1968), Sick & Teixeira (1979), da Silva & Nacinovic (1991), da Silveira & Pais (1986), Teixeira & Antas (1981), Teixeira & Sick (1981), Teixeira & Snow (1982), Vaurie (1967c).

Class AVES
Order GALLIFORMES
Suborder PHASIANI
Family MELEAGRIDIDAE (TURKEYS)



- Large terrestrial birds, with bulky body and generally dull plumage; males have variety of appendages on brightly coloured bare skin of head and neck.
- 71-110 cm.



- North and Central America.
- Arid to mesic terrestrial environments with mixture of forest and grassland, or agriculture.
- 1 genus, 2 species, 7 taxa.
- No species threatened; none extinct since 1600.

Systematics

Turkeys are thought to have originated in Central America over 10 million years ago. There is a strong fossil record of these birds, essentially as a result of their large size and compact bones. *Rhegmenornis*, a species with pheasant- and turkey-like characteristics is known from fossils in Virginia, USA, dating back to 20-16 million years ago. Fossil records for *Meleagris* date to the Miocene, 15-8 million years ago, and the upper Pliocene, 3-2 million years ago, and have been found in diverse regions of the USA, including Virginia, Florida, Texas and California. Historically, the name "Turkey" has also been applied to cranes (*Grus*), vultures (*Cathartes*) and the Western Capercaillie (*Tetrao urogallus*). The domestic turkey arose from *Meleagris*.

Two species are recognized, the Wild Turkey (*Meleagris gallopavo*) and the Ocellated Turkey (*Meleagris ocellata*). The latter was formerly placed in a separate, monotypic genus, *Agriocharis*, but in the 1950's it was reclassified in *Meleagris*, on the basis of morphological evidence. While the plumage and mating behaviour of the two species show distinct differences, skeletal characteristics are highly similar, and eggs are nearly indistinguishable in both size and coloration. Hybridization trials involving Wild and Ocellated Turkeys, using artificial insemination, produce fertile F₁ males, supporting the contention that congeneric classification is more appropriate. No hybrids of free-living individuals have been reported.

The species are alternatively classified in their own family, Meleagrididae, or as a subfamily in the much larger Phasianidae, and there is no consensus on this matter at present. Molecular data show that turkeys are more closely related to pheasants (*Phasianus*) than to other members of Galliformes. Anatomical, immunological and genetic data have at times been used by various authorities to contend that Phasianidae or Meleagrididae is the more appropriate treatment. Hybridization tests show crosses between a domestic turkey and a Ring-necked Pheasant (*Phasianus colchicus*) produced 23% hatchlings, whereas a cross between a turkey and a domestic chicken (*Gallus*) produced 20% hatchlings. Genetic data suggest that turkeys diverged from pheasants about 11 million years ago.

Turkeys were probably distributed continuously from middle latitudes of North America to northern South America during the Pleistocene. Today, the Ocellated Turkey is isolated in the Yucatán region of southern Mexico, Belize and Guate-

mala, separated from the Wild Turkey by intervening tropical rain forest. The genus *Meleagris* is not known to exist today in South America, except as a domestic form.

Morphological Aspects

Turkeys are unmistakable, due to their large size and generally dark plumage. Other very characteristic features are the sparse feathering on the head and the robust legs.

Males stand 110 cm tall and weigh approximately 4-6 kg, in the Ocellated Turkey, or 8-10 kg, in the Wild Turkey. Females are smaller, but are still far larger than most other North American birds, at 90 cm tall and 4-5 kg. Turkeys are largely cursorial and have long, strong legs, which are dark coloured in first-year birds, but red in adults. When disturbed, turkeys prefer to run rather than fly, and will often move uphill, sometimes with their heads stretched out in front of them as they run.

In flight, turkeys show large rounded wings and broad tails. Their wings are adapted for short, powerful flight, and their ratio of body weight to wing area (1.05 g/cm²) is one of the highest among all bird species. The style of flight is characterized by a short, powerful take-off, followed by a long glide, for distance flying. A flight typically begins from a tree or a ridgetop, and often involves the bird gliding as far as a kilometre. During the short bursts of active flight, birds can attain flying speeds of 100 km/hr. Young turkeys develop their flight capabilities at two to three weeks of age.

At a distance, turkeys appear dark brown to black. Plumage is, in fact, generally brown, apart from the primaries, which are black barred with white. Albino, melanistic and erythristic (red) colour morphs are rare in the wild. Incomplete albinos are the most frequently reported variant, whereas complete albinos have not been recorded, except among domestic turkeys.

The plumage of males is iridescent and the breast feathers are tipped with black. The tail-coverts and rectrices of the Ocellated Turkey have eye-shaped, iridescent blue ocelli, which are the origin of its vernacular and scientific names.

Males possess few or no feathers on the head and neck, and the skin appears folded and lumpy, with wattles and caruncles. The frontal caruncle is a conical structure about 1 cm high, above and just behind the bill, and it can extend and droop over the side of the bill 6-8 cm. During the breeding season,

The ratio of body weight to wing area in the turkeys is one of the highest in any birds, in spite of the fact that their wings are large and rounded. This explains why most of their movement is on foot and why, even when in danger, males prefer to run away, unless closely pressed. Females, on the other hand, with a body weight about half that of the males, are better fliers and nearly always fly away from danger. The bird beats its wings very rapidly until it reaches a suitable height, and then glides down to land on a tree perch or on the ground.

[*Meleagris gallopavo silvestris*.

Photo: Marcia W. Griffen]



the wattles and caruncles of the Wild Turkey become larger and can change colour rapidly, from bright red to blue, and turquoise to white, but throughout the remainder of the year, the top of the head is bluish and the neck is red. The head and the neck of male Ocellated Turkeys are bright blue with orange caruncles.

Male Wild Turkeys have a black and grey bristle-like structure that erupts from the breast, called a beard. The beard lengthens with age, measuring about 5 cm in six month old males, and up to 25-30 cm on males over two years old. The beard is not moulted each year with all other feathers, but grows continuously, its length limited by wear, which results from frequent contact with the ground, as the turkey bends over to feed. Male turkeys also possess metatarsal spurs, each of which is composed of a bony core with a covering of keratin. The spurs grow in length and sharpness with age, reaching a maximum of about 35 mm.

Plumage in females is dull, and the breast feathers are tipped with buff. Females have more feathers on the head and neck, and much smaller caruncles and wattles than males. Feather colours are controlled by hormones, and, as a result of this, the removal of the ovaries will result in the bird developing male coloration. About 10% of female Wild Turkeys develop beards, but their structures are thinner and shorter than those of males. Females also show a small spur-button composed of keratin.

Descriptions of moulting patterns are only available for the Wild Turkey. This species moults through five different plumages: natal; juvenile; first-basic (first immature); alternate (first winter); and adult. Natal down is yellow with brown markings; juvenile plumage is brown; and adult coloration begins with the first-basic plumage at about three months of age. Primary moult is descendant (from the innermost outwards), and generally turkeys do not replace the ninth and tenth primaries in the first winter plumage. In the post-juvenile (alternate) moult, the rectrices are replaced centrifugally (in bilateral symmetry from the inside out), though complete replacement does not occur until the birds achieve full adult plumage at about 17 months. In adults, in contrast, the tail moults centripetally (from the outside in), though rather irregularly. Adults moult annually during the summer months, but because it is continuous, birds do not lose their flight ability. Ageing of Wild Turkeys is possible for up to at least three years, based on moult patterns in young birds and spur length in adult males.

The subspecies of the Wild Turkey can generally be identified by plumage colour. Those living in eastern North America,

the Eastern Wild Turkey (*silvestris*) and the Florida Turkey (*osceola*), are darker in colour, especially with respect to the tail-coverts and the terminal band of the rectrices, than the western subspecies, the Rio Grande Turkey (*intermedia*), Merriam's Turkey (*merriami*), and Gould's Turkey (*mexicana*). The colour of the tip of the tail varies from chestnut brown to white. However, there is considerable variation in this feature amongst birds occupying a given region, perhaps resulting from interbreeding with domestic turkeys, or the mixing of subspecies during early restoration programmes.

Habitat

The dominant characteristic of suitable habitat for turkeys is a combination of trees and grasses. In such areas, the proportional distribution of trees and grasses can vary widely, as long as both are present. Trees provide food and overhead cover. Turkeys roost off the ground at night, and trees provide roost-sites, but they will also roost in man-made structures. Grasses provide food directly in the form of seeds and leaves, and indirectly as habitat for insects. In eastern North America, forests with grassy clearings, or open, grassy understoreys provide good habitat. In the south-western United States, turkeys substitute powerline poles and windmills for trees, as night-time roosts. Where they are not harassed, turkeys will live in close proximity to humans, often using bird-feeders in suburban areas.

Turkeys nest on the ground, and nests are generally found where there is dense ground cover. Early in the spring, before herbaceous vegetation has grown up, nests can be found in forests near the base of a tree, in brush piles, or in shrubby forest edges. Ideal nesting habitat is provided where forest harvest has removed over 50% of the overstorey, because during the first five to ten years after overstorey removal these areas produce thick stands of shrubs such as raspberry (*Rubus*), and usually have grassed access roads for logging equipment. In such areas, females nest in the edges of the shrub cover, and use the grassy areas for feeding. It is hypothesized that turkeys will nest as close to brood habitat as possible, and that this leads them to nest in open fields, once herbaceous vegetation grows over 50 cm tall. If the first nesting attempt is disrupted, second nests are frequently located in open fields.

Turkey poults are precocial and nidifugous, leaving the nest within hours of hatching. There are three important qualities to



The habitat of the Ocellated Turkey is dense tropical forest, and it apparently prefers areas with open grassy clearings. This species has a more glossy plumage than the Wild Turkey, and its tail feathers have a series of characteristic eye-shaped spots or ocelli, from which it receives both its scientific and common names. Another distinctive feature is the presence of orange caruncles on the cobalt blue bare skin of the head. In other aspects, however, such as skeleton structure, the two species are very similar, so that generally the Ocellated Turkey is no longer placed in a separate genus, *Agriocharis*.

[*Meleagris ocellata*, Tikal National Park, Guatemala.
Photo: A. de Sostoa & X. Ferrer]

brood habitat: an environment that produces an abundance of insects, and in which poults can feed efficiently; conditions that permit feeding throughout the day without thermal stress; and, thirdly, enough cover for the chicks to hide from predators. Forests with grassy understoreys and oak or pine savannas historically provided brood habitat. Today, forest cover interspersed with pastures or hayfields provide excellent brood habitat. The structure of hayfields is such that poults can move through the vegetation but are hidden from overhead predators, while females stand tall enough to see over the top of the vegetation and detect predators at a distance.

During autumn and winter, turkeys increase their use of forest habitats and decrease their use of open areas, to take advantage of more abundant food resources and thermal cover. Turkeys will scratch down through leaves or snow to get at food, and will feed in agricultural areas, where waste grain is prevalent in farm fields after cropping and the spreading of manure. The distance turkeys will venture from forest cover appears to depend on how frequently they are harassed by predators or people. During cold weather, they prefer to roost in coniferous trees where the trees are mature enough to have large, horizontal-spreading branches.

General Habits

Turkeys are social species and spend most of the year in flocks of 6-20 individuals. An exception is during nesting, when females are solitary for much of the 41 days of egg-laying and incubation. Once the nidifugous chicks hatch, they imprint on their mother within the first 24 hours after hatching. The group of female and chicks then remains isolated from other turkeys for the first few weeks of the young birds' lives. Thereafter, different females and their broods begin to interact with increasing frequency and multiple broods are common, involving three or four adult females and their young. It is hypothesized that these multiple broods are composed of related females and their broods, although this has yet to be proved. During the winter months, flocks congregate around locally abundant food resources, and flock size may vary daily, sometimes numbering in the hundreds. Despite the size of these flocks, a well defined

social hierarchy, or pecking order, develops, and this is maintained by aggressive display and periodical fighting.

Young males leave the brood flock in mid- to late winter, just before the onset of the breeding season. Sibling males travel together and it seems that they apparently remain together for life. These young males probably do not participate in breeding during their first year, because they do not achieve sexual maturity until late in the breeding season, and also because they are subdominant to older males.

Turkey populations pioneer their way into new habitats through the dispersal of females. Young females apparently copulate in early spring and then disperse as much as 50 km away to nest. In good habitats, pioneering populations show rates of growth that can be as high as threefold per year.

Voice

Voice is yet another feature that shows marked disparity in the state of our knowledge of the two species. A total of 28 different vocalizations has been catalogued for the Wild Turkey, whereas most calls of the Ocellated Turkey have not yet been described.

In the Wild Turkey, vocalizing begins while the young bird is still in the egg, and it is thought that these vocalizations help to synchronize hatching. As social animals, voice recognition is important and turkeys are known to recognize the voices of many different individuals.

Calls range from whistles to clucks, to yelps, to drumming sounds. Most calls are variable and dependent on the context, allowing for the communication of complex messages. Only the gobble is of fixed intensity. Males gobble to attract females during breeding, when the call can be heard over 2.4 km away by human ears. The Ocellated Turkey's gobble is distinctly different from that of the Wild Turkey, and has been transliterated as "wump-wump-wump pum-pum-pum-peedle-glunk".

Food and Feeding

Turkeys begin life feeding almost exclusively on insects, but as they mature, they shift to an omnivorous diet. Young turkeys

are rarely fed by the adult and rely on a yolk reserve for the first four days of life while learning to catch insects. Studies have shown that a seven day old turkey poult requires 12 g of protein per day to meet minimum requirements, and young birds have been observed to consume 3000-4000 insects per day. At about six weeks old, poults start taking plant matter. Seeds of all sizes are consumed, from grass under 1 mm in diameter to walnuts (*Juglans niger*) over 250 mm wide. Grit is an important sideline to the diet, as it is required as an abrasive in the gizzard to help with the digestion of seeds and nuts.

Adult turkeys are opportunistic omnivores, as shown by the fact that over 100 different food items have been identified in the crop and gizzard of turkeys at one locale. Leaves of grasses and herbs, flowers and fruits, and insects are all important in the diet during the summer. Turkeys regularly scratch down through leaves and soil for food and, in autumn, large areas of the forest floor appear to have been churned by turkeys. In winter, turkeys will scratch for plant rhizomes. Waste grain from agriculture is a key food resource in northern latitudes. In areas where snow is periodically over 30 cm deep, too deep to allow turkeys to scratch down to food on the ground, the birds will remain in trees, feeding on buds. Experiments have shown that turkeys can fast for about two weeks, and can lose as much as 50% of their body weight and still recover.

Breeding

While far more work has been carried out on the Wild Turkey, the two species seem to be biologically very similar. Breeding is cued by photoperiod. Blood plasma levels of testosterone in males and prolactin in females begin increasing in late winter, and copulation and egg-laying occur in the spring. Hormonal activity is influenced by physical and social conditions. Males reach sexual maturity at about 12 months old, but may mature earlier, if food resources are good and they are not socially inhibited by older adults. Females can breed at 10 months old, but often do not do so in populations of high density. Parthenogenesis, the production of progeny from an unfertilized egg, a most unusual phenomenon in the vertebrate world, is documented in domestic turkeys, and it is suspected to occur in the wild. All offspring from parthenogenesis are male, and about 20% can produce viable sperm.

Courtship behaviour includes both vocal and visual cues. Males announce their intentions by producing a gobble call, which may attract females from a distance. The male's visual display during courtship involves him drooping the wings, and erecting and fanning the tail feathers and most of the other dorsal feathers. In the Wild Turkey, the head is held upright, and the bright red, blue and white colours on the head contrast with the black feathers; in the Ocellated Turkey, in contrast, the blue head and neck are held tightly against the back. At close range, a low puffing sound can be heard. A receptive female squats and the male mounts by climbing up on her back.

Females nest in a crude depression on the ground and lay 8-15 eggs, normally about 12; these are creamy or buff with irregular brown speckles and blotches, and measure roughly 62 x 45 mm. Eggs are laid at a rate of one every 25 hours. Incubation generally begins when the sixth egg is laid, and lasts about 28 days. Whether or not a female nests is dependent on her physiological condition, especially her fat reserves. Birds that have lost a significant amount of weight during the winter months, due to food shortages, may defer nesting for a year. If the first nest is lost, turkeys will renest, but females over two years old are more likely to renest than younger birds. Nest success is generally less than 50%, although it tends to be somewhat higher for older females. The sex ratio amongst the poults that hatch is approximately equal, which implies that annual mortality rates are also likely to be similar between the sexes. Males do not participate in any aspect of nesting or the raising of the brood.

Turkeys are capable of living more than ten years in the wild, but in most areas, survival beyond five years is unusual. Mortality is greatest in the first three weeks of life, when 50% of the young birds die, due to predation, diseases, hypothermia or accidents. Females on nests, too, are especially vulnerable to ground predators, such as foxes (*Vulpes vulpes*, *Urocyon cinereoargenteus*), skunks (*Mephitis*) and raccoons (*Procyon lotor*). The principal causes of mortality among adults are predation and hunting. Golden Eagles (*Aquila chrysaetos*), coyotes (*Canis latrans*) and bobcats (*Lynx rufus*) are common predators. Turkeys are also susceptible to a wide variety of viruses, bacteria, mycoplasmas and parasites. Histomoniasis, or black-head disease, caused by a protozoan, *Histomonas meleagridis*, is among the most frequently reported in the Wild Turkey, and *Mycoplasma gallisepticum* and *Syngamus trachea* (a nematode)

Dust-bathing is a maintenance activity to which turkeys devote a lot of time, particularly during the nesting period and before and during the moult of the body feathers. Birds often manage to cover their entire plumage with dust, by means of flapping and kicking. It seems that this rids them of parasites and keeps their plumage in good condition.

[*Meleagris gallopavo*
silvestris.
Photo: Gary W. Griffen]





Fighting between turkeys takes place periodically, and it serves to establish and maintain the pecking order amongst flock members. Fights are normally between birds of the same sex, thus forming two independent hierarchies in mixed-sex groups. The actual form of fighting is based on mutual threats, striking with the wings and kicking. It is similar in both sexes, although females tend to fight less vigorously than males.

[*Meleagris gallopavo silvestris*.
Photo: Gary W. Griffen]



The "Strutting" posture constitutes the main visual display of the male Wild Turkey during courtship. The tail and most of the dorsal feathers are erected and fanned out; the wings are lowered, with the central primaries touching the ground; the crop is inflated, thus accentuating the bright red bare skin that covers it. At moments of maximum excitement the bird makes a low sound, which has been transliterated as a "chump" followed by a "hummm"; at the same time, the tail feathers are vibrated rapidly.

[*Meleagris gallopavo silvestris*.
Photo: Gary W. Griffen]

are considered threats to native and domestic turkey populations. Annual survival rates for adult turkeys are about 70%.

Movements

Turkeys are largely cursorial birds, roosting in trees at night and spending most of the daylight hours walking on the ground. Their style of flight is similar to that seen in the pheasants, quails and grouse (see Morphological Aspects).

Daily and seasonal movements depend on food supply and weather conditions, but often involve a bird covering several hundred hectares. On the other hand, where food resources are abundant, turkeys will remain in areas as small as a few hectares. Snow over 30 cm deep limits movements, and when it is fluffy, turkeys may remain roosting in trees for days. In some areas, turkeys show localized migration between winter and summer ranges, but these are normally movements of under 10 km. The annual home range of turkeys generally encompasses about 1000 hectares.

Copulation in the Wild
Turkey starts when a soliciting female squats in front of a strutting male, allowing him to climb on her back. The male's rounded breast actually prevents him from seeing the female during treading. It is thought that the function of the "beard", the tuft of coarse filaments that erupts from the upper breast, is to help the male guide himself towards the female for mating. The male *Ocellated Turkey* (*Meleagris ocellata*) lacks the beard, but it appears that, by holding his head further back in the strutting posture, he is able to see the female and thus orientate himself properly.

[*Meleagris gallopavo silvestris*.
Photo: Gary W. Griffen]



Relationship with Man

The common name Wild Turkey originated with early European colonists to North America who were familiar with the domestic turkey in Europe and now encountered the wild form. The domestic turkey of Europe had, in its moment, been derived from stock obtained in Mexico by early Spanish explorers. The name "Turkey" was in wide use in Great Britain long before species arrived, used generally as a reference to any large bird that spread its tail.

The name *Meleagris* arises from Greek mythology. Homer recounts the death of Meleager, son of the king of Calydon, in the *Iliad*. In mourning the loss of their brother, Meleager's sisters are transformed into birds, *meleagrides*. The name *meleagrides* was used by the early Greeks for certain African birds, almost certainly the guineafowl (see page 561), and the name *Meleagris* was subsequently applied inaccurately by Linnaeus to the turkeys.

The turkey has always been an important species to humans inhabiting the Americas. As a food resource, it was important because of its abundance, its relative ease of domestication and its nutritional qualities. As a wild species, the turkey has attracted attention because of its size and its social behaviour, and as a symbol of success in conservation programmes.

Native Americans relied heavily on the Wild Turkey. Archaeologists have observed that turkeys are the second most common vertebrate, after the white-tailed deer (*Odocoileus virginianus*), in the refuse collections of native Americans during the pre-Columbian era. Feathers were used to make blankets and clothing, and the fletchings of arrows; bones were fashioned into instruments for punching holes in leather or sewing needles; and spurs served as arrowheads. Native Americans in the south-west USA and Central America domesticated the turkey.

Interestingly, two sharply contrasting hypotheses have been advanced about the origins of the domestic turkey. Some authorities state that Merriam's Turkey (*M. g. merriami*), which inhabits the south-western USA, is the progenitor of the domestic turkey. Archeological data suggest that turkeys were kept by native Americans, who inhabited what is now north-western New Mexico and north-eastern Arizona in about

AD 500-700. Trade among native peoples brought the domestic turkey into Mexico and Central America.

The alternative hypothesis suggests that turkeys were domesticated in Mexico and Central America, and that trade brought them into the south-west of what is now the USA. Merriam's Turkey, instead of being the progenitor of the domestic turkey, may actually be derived from feral domestic turkeys. Uncertainty about the origins of the domestic turkey and Merriam's Turkey persists, because it is likely that Wild Turkeys were domesticated several times over the past 2000 years, and also that individual birds commonly escaped from domestic flocks.

The history of domestic turkeys in European culture began in 1519, when the Cortés expedition to Mexico brought the domestic turkey of the Aztecs back to Spain. The turkey was well established in Spain by 1530 and in Great Britain by 1541, and was part of the livestock brought by the first European colonists to North America in 1607. While American folklore describes the turkey as an important food at the first Thanksgiving held by the Pilgrims in Massachusetts, it appears doubtful that the turkey was part of the Thanksgiving tradition until 1800.

Today, the domestic turkey is probably the most widely known form of the species, and we often think of turkeys as having white plumage. However, until recently domestic turkeys raised on small farms throughout North America showed plumage similar to Wild Turkeys. Domestic and wild birds hybridized frequently, because Wild Turkeys would venture in to farmyards to mate with domestic birds, or farmers would take Wild Turkey eggs from nests to be hatched and raised by domestic hens. This mixing, in combination with selective breeding programmes, created a wide range of recognized colour morphs. In the past 30 years, poultry has become an increasingly valued kind of meat, and the turkey is the basis for a major livestock industry. Intensive breeding has produced a form of turkey that today differs markedly from the Wild Turkey. The modern domestic turkey has greater development of the breast muscle, a heavier tarsometatarsus and the all white plumage.

Wild turkeys are considered to be among people's favourite species of wildlife for both photography and hunting. Their



Clutch size in the Wild Turkey is usually of between 10 and 13 eggs, although there are records of as few as 4, and up to 17 eggs, all laid by the same female. Even higher numbers of eggs, up to 26, have been found, as a consequence of dump-laying, whereby two separate females visit the same nest at different times to lay their eggs. Incubation is carried out by the female only, and she turns the eggs periodically, normally moving several eggs with each movement of her head.

[*Meleagris gallopavo silvestris*.
Photo: Gary W. Griffen]

large size, their breeding displays, and, until recently, their rarity, have made turkeys a prize species to see. However, the social nature of these birds may be the most important reason for such attention. The vocalizing that turkeys perform, in association with the spring breeding season, is relatively easy for people to mimic. Turkeys can be drawn in to a human caller and the experience of interacting with a wild species has proved very attractive. Wild Turkey calling is so popular that contests are held throughout the USA.

Populations have reached such numbers that annual hunting seasons are allowed in most areas. Hunting generally occurs in both the autumn and spring, and involves extensive use of calls. During the autumn, hunting is allowed for either sex, and hunters seek to flush a flock, dispersing it in several directions. Hunters mimic the calls that turkeys use to re-establish contact with one another. In the spring, only the males are legal quarry and hunters mimic the calls of females to lure a male in close enough to shoot. Hunting has gained such popularity that organizations and popular magazines dedicated exclusively to turkey enthusiasts have arisen. Annual fund-raising efforts undertaken by hunters generate \$500,000 each year in support of research and management.

In the near future, the relationship of the Wild Turkey with respect to humans could change from that of a highly desired species to that of a pest. The turkey is highly adaptable, and populations have expanded into agricultural areas. Studies show that as many as 30% of farmers claim turkeys have caused significant damage to crops. More recently, turkeys have begun to inhabit suburban areas. The bird seems to be attractive until people recognize the impact a flock of these large birds has on bird feeders. Population sizes can be controlled in agricultural areas through hunting. However, such an option is less acceptable in suburban environments, presenting a management dilemma.

Status and Conservation

The Wild Turkey is one of the world's foremost examples of species conservation. Its restoration is a history replete with

failure due to ignorance, followed by astounding success built on research.

Pre-Colombian era populations are thought to have numbered in the tens of millions. Early descriptions reported individual flocks in the hundreds. Turkeys competed with Passenger Pigeons (*Ectopistes migratorius*) for beechnuts (*Fagus grandifolia*), acorns (*Quercus*) and chestnuts (*Castanea dentata*). While turkeys were numerous in the heavy forests of eastern North America, they may have reached their greatest densities in the oak and pine savanna ecosystems of the Midwest and South. Some areas probably supported autumn population densities of over 80 birds/km².

Turkeys proved especially vulnerable to hunting, when firearms were introduced by European colonists. Populations declined rapidly around the early colonies due to unregulated hunting, and the species was completely exterminated over large areas. Game laws were enacted in some parts of North America by the late 1600's, controlling the seasons of the year when hunting was allowed and the number of turkeys that could be taken. However, enforcement was inadequate, and once turkeys had been eliminated from an area, restoration proved impossible. This pattern of overexploitation was accompanied by clearing of much of the forestland in eastern North America, and, as settlement moved west, turkey populations were steadily destroyed. Only large swamps, large forests on rugged terrain, and mountainous regions, areas bypassed by settlement, continued to support turkeys. Remaining turkey populations became increasingly isolated, and estimates by conservation agencies in the early 1940's put the total population of the species at under 300,000 individuals. Most of these populations were in the southern portions of the historical range. Despite such a significant decline, no subspecies is thought to have been lost.

Little progress was made in the conservation of turkeys until the 1950's. With financial resources provided by the Pittman-Robertson Act, entailing an 11% tax on sporting arms and ammunition, enforcement of hunting laws began to improve, the government acquired and began to manage worn out farmland for wildlife habitat, and wildlife restoration programmes got under way. Gamefarm production of wildlife was the focus of the first major restoration efforts. Gamefarms

Just before night falls, the female Wild Turkey starts to brood her chicks, or poults, with her wings half open, a posture she will maintain as they sleep throughout the night. On several occasions it has been noted that poults that were not brooded during heavy rain or low temperatures died, whilst those that were protected by the mother survived. The poults are brooded on the ground for about the first two weeks, until they are able to fly up into a tree in which to spend the night. Thereafter, they roost in trees, usually beside the female for the first few weeks, or even, in the first days, under her wings, as here. As the weeks pass, roosting groups spread out, until they occupy more than one tree, usually by about the eighth week. The natal down that covers the chicks at hatching is steadily replaced by the feathers of the juvenile plumage, which cover the whole body after four weeks. However, the covering of tawny down, splotted with brown on the hindcrown and nape, remains many weeks more on the head and neck, where the contour feathers do not appear until the poult is ten weeks old.

[*Meleagris gallopavo silvestris*.

Photo: Gary W. Griffen]





The coyote (*Canis latrans*) is one of the predators capable of killing adult Wild Turkeys. Others include the bobcat (*Lynx rufus*), the puma or mountain lion (*Felis concolor*) and the Golden Eagle (*Aquila chrysaetos*). Females are particularly vulnerable on the nest during incubation, a golden opportunity for other smaller predators, such as foxes (*Urocyon cinereoargenteus*, *Vulpes vulpes*) and raccoons (*Procyon lotor*). Despite this variety of potential predators, annual survival of adult turkeys is estimated at about 70%. Not surprisingly, poults are much more vulnerable to all sorts of predators, particularly in the first two weeks, when they are still unable to fly up into trees. Eggs are also taken quite frequently by a fair number of animals. The raccoon stands out as the most typical nest robber, but nests have also been destroyed by opossums (*Didelphis virginiana*), skunks (*Mephitis mephitis*, *Spilogale putorius*), bobcats, foxes, woodchucks (*Marmota monax*) and several species of birds.

[*Meleagris gallopavo silvestris*.

Photo: Gary W. Griffen]

The current status of the Ocellated Turkey is poorly known, but it is almost certainly declining, and is as present classified as near-threatened. Habitat destruction, trapping for the live animal trade and hunting for food are the main threats.

[*Meleagris ocellata*,
Tikal National Park,
Guatemala.

Photo: Yves Lefevre/Bios]

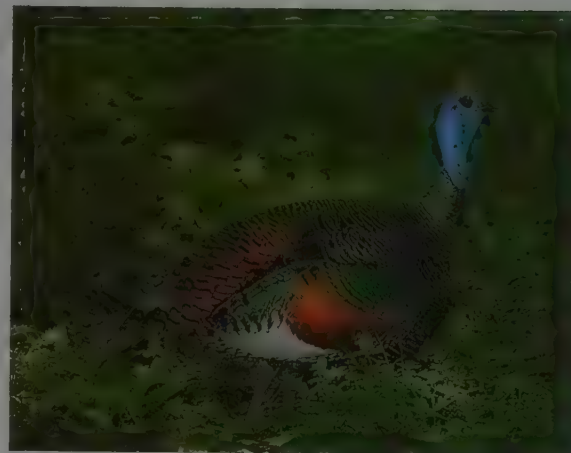
hatched and raised turkeys in captivity until they were 12-20 weeks old. Releases of 330,000 gamefarm turkeys into the wild at 800 sites yielded 760 known failures; only three releases resulted in growing populations. Research showed that gamefarm birds did not possess the genetic and behavioural qualities necessary for survival and reproduction in the wild. Only the most docile wild-trapped birds were able to survive and breed in pens, and it is thought that this resulted in rapid selection for a genotype that was less suited to the wild. Further, young birds in pens did not have an opportunity to learn food and feeding habits, seasonal movements to find food resources and appropriate responses to predators.

Restoration efforts began to achieve significant success in the 1960's, as a result of three factors. First, habitat began to improve, as land historically cleared of its forests for agriculture was abandoned by farmers who found the soils to be only marginally productive. As cultivation and grazing ceased, shrubs and trees became re-established, so that a mosaic of forest, brushland and agriculture came to cover large portions of eastern North America, and this combination proved to be excellent habitat for turkeys. Interestingly, agriculture proved to be more beneficial than detrimental. In the north, the grain and dairy industries proved important, because they provided abundant food resources in the form of fields of corn and hay. The cattle industry in the south-west USA provided watering areas (livestock tanks) and roost-sites (power poles and windmills) in areas otherwise unsuitable for turkeys.

A second factor was a shift in focus of restoration efforts, away from releasing gamefarm stock towards capturing wild birds live and translocating them. Wildlife biologists developed efficient techniques for capturing wild turkeys, based primarily on the cannon-net, a large (15 x 20 m) net that could be shot over a flock of turkeys using projectiles, powered by small cannon charges. Generally, 8-12 females and 3-5 males were translocated to colonize a new area. By the mid-1970's, thousands of Wild Turkeys were being translocated annually from the remnant populations in the south to suitable habitat. Where most releases of gamefarm birds had failed to grow, most releases of transplanted wild birds grew at a rate of twofold or threefold per year. Hunting was not permitted until the populations were of sufficient size to sustain an annual harvest, and people living near these releases were so protective that losses to illegal hunting were negligible. Areas of habitat that were similar to those supporting existing populations were quickly filled and the focus shifted to research.

Science was the third critical factor in the restoration of the Wild Turkey, because it produced a phenomenal change in our understanding of the ecology of this species. New technology allowed the construction of radio transmitters small enough to be harnessed to the back of turkeys without stressing the birds. These transmitters emitted an electronic signal that enabled biologists to locate an individual turkey at any time, and often know where the bird was, without having to contact it visually and disturb its behaviour. Habitat needs could be studied directly, by tracking turkeys throughout each day, season and year. Reproduction could be studied, because females could be tracked to the nest and the number of eggs counted when she was absent. Special circuits in the transmitter allowed biologists to know quickly when a bird died and determine cause-specific mortality. By the 1970's, extensive studies involving the radio tagging of hundreds of birds were under way. Biologists examined the effects of severe winters, predation and hunter harvesting on turkey populations. Computer modelling became part of the research process in the 1980's as biologists began to unravel the complex ecology of the species.

Among the most important findings of this research were those pertaining to the habitat requirements of the Wild Turkey. In the 1950's, nearly all the remaining populations existed in areas composed of large blocks of over 10,000 ha of mature forest, and biologists believed that large forested areas were required by the bird. Research in a newly restored population in the upper valley of the Mississippi River showed why agriculture was proving to be beneficial. Turkeys could thrive in areas of interspersed forest and agriculture, and this landscape



condition was common to much of the eastern USA. Criteria for discerning suitable habitat continued to emphasize the amount of forest cover available to turkeys, until research showed that turkeys could thrive in areas with as little as 5% forest cover. That finding dramatically increased the amount of habitat available for translocation efforts.

Annual population surveys were instituted in the 1960's, to monitor the impacts of hunting and assess harvest regulations. Investigations in the 1980's and 1990's drew on these long-term data sets and showed that the dynamics of turkey populations are controlled by a complex interaction of factors. In general, modern hunting programmes in the USA have little impact on turkey populations, because of the combination of conservative hunting regulations, strict enforcement and the high reproductive potential of the turkey. The more important factors were related to nesting success and the survival of young through the first summer. Studies of turkeys, tagged as poults with very small transmitters, showed that losses of 50-90% were common. Biologists, using female turkeys imprinted on humans, observed females with young broods at close range, and showed that cold and wet weather during the first few weeks after hatching can lead to substantial losses of young birds due to hypothermia.

As a result of the changes in habitat and the conservation efforts, Wild Turkey populations have grown dramatically, reoccupying much of the former range, and thriving in places beyond historical limits. By 1990, all subspecies had shown remarkable increases in numbers, with total populations estimated at approximately 3.5 million. The species was found in 49 states in the USA, three provinces in Canada, and six states in Mexico. Efforts to restore the turkey to all of its historical range continue today, and in 1993 over 7500 individual turkeys were translocated.

Attempts to naturalize Wild Turkeys in Europe have been in progress since the 1880's. Until the 1970's these efforts were based on gamefarm stock and the experience was the same as in North America, continual failure. Translocation of wild stock began in 1978, with releases in the north-west Taunus Forest, north of Frankfurt. In five years the population grew impressively, from 14 to an estimated 150 birds.

While our knowledge of the Wild Turkey has expanded remarkably in the past 20 years, the Ocellated Turkey remains a mystery. Most research to date has been based on museum specimens and a few, limited observational studies of birds in the wild. No ecological work has been conducted, making it difficult to mount conservation programmes. Pilot studies began in 1992, with the aim of learning effective techniques for live-trapping, and also for the application of radio telemetry to this species.

General Bibliography

- Askins (1955), Baird (1867), Cracraft (1968), Gutiérrez *et al.* (1983), McKusick (1986), Miller (1940), Olsen (1960, 1961), Porter (1985a, 1985b), Raethel (1988), Rea (1980), Ridgway & Friedmann (1946), Rutgers & Norris (1970), Schorger (1963, 1966), Steadman (1980), Stock & Bunch (1982), Sych & Bogdanovich (1988), Verheyen (1956).



PLATE 35

inches 16
cm 40



PLATE 35

Family MELEAGRIDIDAE (TURKEYS) SPECIES ACCOUNTS

Genus *MELEAGRIS* Linnaeus, 1758

1. Wild Turkey

Meleagris gallopavo

French: Dindon sauvage **German:** Truthuhn **Spanish:** Guajolote Gallinazo
Other common names: Eastern Wild Turkey (*silvestris*); Florida Turkey (*osceola*); Rio Grande Turkey (*intermedia*); Merriam's (Wild) Turkey (*merriami*); Gould's Turkey (*mexicana*)

Taxonomy. *Meleagris gallopavo* Linnaeus, 1758, North America = Mexico.

Birds of NW Mexico sometimes awarded separate race, *anasta*. Six subspecies normally recognized.

Subspecies and Distribution.

M. g. silvestris Vieillot, 1817, - E North America, N to S Ontario, W to Great Plains, and S into Texas and N Florida.

M. g. osceola Scott, 1890 - Florida.

M. g. intermedia Sennett, 1879 - Kansas S into Mexico; also translocated to areas W of historical range including California, Oregon and Washington.

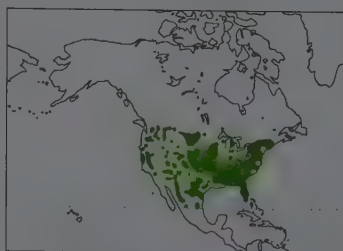
M. g. merriami Nelson, 1900 - W Great Plains and Rocky Mts; also translocated to areas W of historical range including Wyoming, Idaho, Oregon and Washington.

M. g. mexicana Gould, 1856 - Mexico, in mountains W of Central Plateau.

M. g. gallopavo Linnaeus, 1758 - Mexico, from Veracruz W to Jalisco, and S to Guerrero.

Introduced to Hawaii (*intermedia*), Europe, Australia and New Zealand.

Descriptive notes. Male c. 110 cm, and c. 10,000 g; female c. 90 cm, and c. 4000 g. Colours of rump feathers, and terminal band of rectrices vary from chestnut to cream. Birds in more arid environments are lighter coloured; males darker than females. Terminal band of breast feathers is black in males, buff in females. Males and c. 10% of females have pendulous, bristle-like "beard", 10-25 cm long; not moulted. Males lack feathers on the head and neck, and skin chromatophores allow variation in colour, especially during courtship, from red to white to blue. Races vary in



body size and plumage coloration: N races larger than S races; populations in E North America, (*silvestris*, *osceola*) darker, especially on tail-coverts and terminal band of rectrices, than those from W (*intermedia*, *merriami*, *mexicana*).

Habitat. Tolerant of broad range of conditions, from temperate and subtropical forest to shrub-steppe. Highest densities occur in areas containing mixture of mature hardwood forest, shrublands, and grassland or agricultural land. Nest generally situated in dense cover. Roosts above ground at night in trees or man-made structures.

Food and Feeding. Most feeding occurs on ground. Young, after leaving nest within hours of hatching, feed on insects during first 6 weeks of life. Thereafter, diet composed of seeds, fruit, tubers and leaves of plants; acorns (*Quercus*) are important food in autumn; waste grain from agriculture important during winter, in areas where snow covers ground for extended periods. Grit necessary as an abrasive substance, working in conjunction with muscles of gizzard. Scratching on forest floor during autumn is tell-tale sign of presence of species.

Breeding. Gregarious with well developed social hierarchy. Starts in early spring, with males gobbling and displaying (see page 367). Nest is shallow scrape on ground, generally in dense cover. Female isolated during nesting. Lays 10-13 eggs (c. 1 egg every 25 hours); incubation 28 days; males do not share in nesting effort. Young nidifugous, remaining with female for 9-11 months. First breeding at 1-2 years old. Nesting success averages c. 45%; species will re-nest if first nest is destroyed. Egg fertility and hatching rate over 90%; poult survival to 4 weeks old averages 35%.

Movements. Not long distance migrants, moving only 5-20 km; some altitudinal migration occurs in mountainous terrain. Seasonal movements marked by intensive use of relatively small areas of under 100 ha, with periodical shifts to other areas. Annual home range generally c. 750 ha (500-1000 ha). Movement most extensive in spring, winter snow can restrict movement to under 10 ha. Maturing females may disperse up to 50 km from natal area.

Status and Conservation. Not globally threatened. Numerous and hunted as game species throughout much of range. Populations declined as result of overexploitation, with total numbers

estimated at under 300,000 birds in 1940's. However, dramatic increase as result of conservation efforts. Research conducted during 1970's showed species tolerant of broader range of habitat conditions than previously thought. Programmes of live-trapping and transfer conducted during 1970's and 1980's, re-establishing species throughout much of historical range, so that present species is now one of most widely distributed galliforms in North America. Populations today estimated at 3,500,000 birds. Tightly controlled hunting permitted in spring and autumn throughout much of range. Situation in Mexico poorly known; may be at risk. Species has been introduced well beyond historical range, including many states of W USA (including Hawaii) and some provinces of Canada; also established in Germany, New Zealand and several small islands off SE Australia.

Bibliography. Alison (1976), Bailey (1955, 1956), Beasom (1970), Beasom & Pattee (1978), Beville (1973), Bohl & Gordon (1958), Buchholz (1994), Campo *et al.* (1989), Davidson *et al.* (1985), Davis (1976), Day *et al.* (1991), Dickson (1992), Dickson *et al.* (1978), Donohoe *et al.* (1968), Eaton (1992), Ellis & Lewis (1967), Glazener *et al.* (1967), Glidden (1977), Glover (1947, 1949), Gray & Prince (1988), Green (1982), Halls (1975), Healy (1985), Healy & Healy (1990), Healy & Nenno (1983), Healy & Pack (1983), Hewitt (1976), Hillestad & Speake (1970), Hoffman (1991), Holbrook & Vaughn (1985), Holbrook *et al.* (1987), Hurst (1978, 1980), Jonas (1966), Kennamer (1988), Kennamer & Arner (1967), Kennamer & Kennamer (1985), Kilpatrick, Husband & Pringle (1988), Kilpatrick, Litvaitis & Thomas (1990), Korschgen *et al.* (1946), Kurzejeski *et al.* (1987), Leopold (1944), Lever (1987), Lewis, J.B. & Breitenbach (1966), Lewis, J.C. (1973), Liedlich *et al.* (1991), Little & Varland (1981), Lutz & Crawford (1987a, 1987b), Martin *et al.* (1981), Pattee & Beasom (1979), Porter (1977a, 1977b), Porter *et al.* (1980, 1983), Ransom *et al.* (1987), Robertson *et al.* (1943), Rosenthal (1992), Sanderson & Shultz (1967), Schemnitz (1956), Schleidt (1968), Schmutz & Braun (1989), Schorger (1962), Shufeldt (1911), Speake *et al.* (1985), Spittler (1977), Steffen *et al.* (1990), Sweeney (1980), Thomas (1964), Thomas *et al.* (1966), Vander Haegen *et al.* (1989a, 1989b), Vangilder *et al.* (1987), Watts & Stokes (1971), Weaver & Mosby (1979), Whadley *et al.* (1977), Wigley *et al.* (1986), Williams, L.E. (1961, 1974, 1981), Wunz (1971), Zwank *et al.* (1988).

2. Ocellated Turkey
Meleagris ocellata

French: Dindon ocellé **German:** Pfauentruthuhn **Spanish:** Guajolote Ocelado

Taxonomy. *Meleagris ocellata* Cuvier, 1820, Gulf of Honduras.
Historically classified in monotypic genus *Agriocharis*, but observed differences do not appear to justify this treatment. Monotypic.

Distribution. Central America, in Yucatán Peninsula; from N Belize W to E Chiapas (Mexico), and S to N Petén (Guatemala).



Descriptive notes. 71-91.5 cm; male c. 4000 g, female c. 3000 g. Smaller, but more colourful, than *M. gallopavo*. Male lacks "beard", but both sexes have spurs, on males reaching 40 mm long. Tail-coverts and rectrices have eye-shaped, iridescent blue pattern (*ocelli*) on subterminal band; bare skin of head and neck bright blue with orange caruncles. In female, iridescent feathers greener and less bronzed than in male; female too lacks feathering on head and neck. Juvenile much duller, with pink, brown and cinnamon barring.

Habitat. Little known about habitat requirements. Most observations made near areas

characterized by combination of dense forest and open grassy areas. Species uses dense forest during most of year; greatest use of open areas in autumn, especially where agricultural crops available. Birds roost in trees at night.

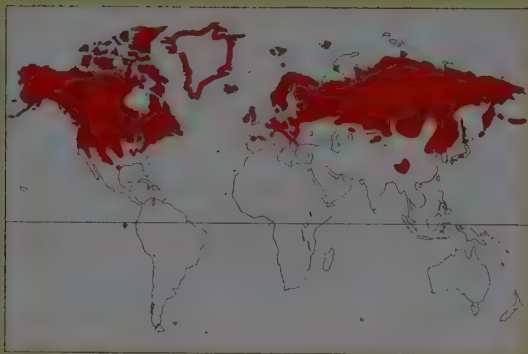
Food and Feeding. Omnivorous, feeding on ground. Grass seeds and leaves, fruits and insects commonly taken; where available, corn is important component.

Breeding. Breeding begins in Mar, with males gobbling and strutting (see page ???); nesting begins in Apr. Nest is shallow scrape on ground. Average 12 eggs (8-15); incubation 28 days, with poults mostly hatching in early Jun.

Movements. Seasonal movements unknown. Limited observations suggest seasonal range of c. 300 ha. **Status and Conservation.** Not globally threatened. Until recently considered to be threatened, in category Insufficiently Known, but has now been reclassified as near-threatened. No estimates available for current population size or even relative abundance. Distribution throughout known range is patchy, because of habitat destruction and hunting pressure. In Guatemala, well protected in Tikal National Park, where birds have become accustomed to people and are rather tame; a reserve for protection of this species has been established in Petén. CITES III in Guatemala; main threats thought to be in form of live animal trade and pressure of hunting for food.

Bibliography. Blake (1977), Coliar & Andrew (1988), Davis (1972), Dickson (1992), Eaton (1992), Gaumer (1883), Land (1970), Leopold (1948), Lint (1952), Monroe (1968), Shufeldt (1914), Smithe (1966), Steadman *et al.* (1979), Storer (1993), Van Tyne (1935).

Class AVES
Order GALLIFORMES
Suborder PHASIANI
Family TETRAONIDAE (GROUSE)



- Large to medium-sized, plump terrestrial or partly arboreal birds, with short, convex bill and feathered nostrils, short legs and feathered tarsi.
- 30-90 cm.



- Holarctic, in boreal zone.
- Forest or open areas, mostly in zones of cold or cold temperate climate.
- 7 genera, 17 species, 129 taxa.
- 1 species threatened; 1 subspecies extinct since 1600.

Systematics

Although there is no doubt that the Tetraonidae constitute a natural and fairly homogeneous group within the Galliformes, it is currently a matter of discussion whether or not this small group of some 17 species should really be considered a separate family. Many authors prefer to regard the group as a subfamily within Phasianidae.

Grouse do, it is true, share many characteristics with the Phasianidae, from general body shape to basic moulting sequences, as well as many morphological and behavioural features. Recent techniques using electrophoresis of egg albumen and, particularly, DNA-DNA hybridization also point to a close affinity between grouse and pheasants, partridges and their allies. Another indication of the proximity of the two groups is the potential for hybridization; for example, the Ring-necked Pheasant (*Phasianus colchicus*), in areas of Europe and North America where it has been introduced, has occasionally interbred with at least four species of grouse.

Some special characteristics of tetraonid morphology are: feathered nostrils; tarsi without spurs, and normally with feathers instead of scales; and toes that, although not always feathered, have peculiar pectinations or small scales along either side of each toe during the winter which help the birds to climb branches and walk on the snow. Another prominent feature is the comb that most species have above the eye; these combs can be bright yellow or scarlet, and tend to develop more in males, and especially during the breeding season. In addition, males sometimes have coloured patches of bare skin on the neck, in some cases with ornamental feathers; these patches are inflated during courtship, by means of expansions of the oesophagus. All these features can be interpreted either as adaptations to cold climates or as aids to typically polygynous or promiscuous mating systems, with sophisticated courtship on the part of the males.

Fossil representatives of the Tetraonidae are known from as early as the Miocene. More specifically, the oldest known grouse, *Paleolectoris incertus* comes from the Lower Miocene of North America, while from the Middle Miocene, also of North America, we have *Tympanuchus stirtoni*, which has been assigned to a rather specialized contemporary genus. Recently however, the generic designation of these and other primitive Tetraonidae has been under question. More present day genera appear in deposits from the Pliocene, with *Tetrao* in Europe,

and the Pleistocene, with *Bonasa* and *Lagopus* in Europe and *Dendragapus* in America. On the whole, fossil records are fairly incomplete, although they do at least allow speculation about the possible origin of the Tetraonidae from primitive Phasianidae during the Miocene. They may be especially close to the snowcocks (*Tetraogallus*) with which they share a peculiar feature, the absence of the abductor muscle of the second digit.

A relatively recent origin for the Tetraonidae would be in line with the comparatively limited degree of morphological differentiation from the Phasianidae, and also with the arguments of those who consider the group merely a subfamily of Phasianidae. However, the family status of the group is defended on the grounds of a combination of morphological, physiological and behavioural peculiarities. These interrelated aspects enable the grouse to occupy an important ecological niche in the vast cold expanses of the Northern Hemisphere, where other Galliformes are virtually absent.

Their obvious adaptations to a cold climate and exclusively boreal distribution suggest that the origin of the Tetraonidae was probably in North America or Eurasia. The fossil record is too limited to decide between these two, but given the distribution of the present day representatives the American continent is perhaps slightly more likely. One genus (*Tetrao*) is exclusively Palearctic, three (*Dendragapus*, *Centrocercus*, *Tympanuchus*) exclusively Nearctic, and three (*Falcapennis*, *Lagopus*, *Bonasa*) Holarctic in distribution, whereas, in terms of species, seven are Palearctic, eight Nearctic and only two Holarctic. Nevertheless, during the period when the Tetraonidae may have originated, and until relatively recently, barely 15,000 years ago, a broad land bridge existed in the area that is now the Bering Straits.

According to various authors, three species found in boreal coniferous forests show the most primitive characteristics of the family. Generic treatment of these species has been very variable, and for some time they were generally awarded three monotypic genera, *Dendragapus*, *Falcapennis* and *Canachites*. A revision of the internal taxonomy of the grouse by L. L. Short in 1967 reduced the number of genera normally recognized from eleven to six, a move which included the amalgamation of these three genera in *Dendragapus*. Recently, however, R. L. Potapov, amongst others, has suggested that two distinct genera should be recognized, advocating the restitution of *Falcapennis*, this name having priority over *Canachites*. Thus, the



The Siberian Grouse is evidently a close relative of the Spruce Grouse (*Falcipennis canadensis*), and the two form a clear superspecies. They have commonly been placed in the genus *Dendragapus*, alongside the Blue Grouse (*Dendragapus obscurus*), but the latter is now judged to be sufficiently distinct, notably in possessing inflatable cervical sacs, to justify generic separation, as a result of which the genus *Falcipennis* has recently been resurrected for the Siberian and Spruce Grouse. According to various authors these three species are the most primitive living members of the family, the closest relatives of the ancestral form from which all grouse originated.

[*Falcipennis falcipennis*, Russian Far East.
Photo: R. Seitre/Bios]

Blue Grouse (*Dendragapus obscurus*) of America would now be split off from its traditional congeners, the Siberian Grouse (*Falcipennis falcipennis*) of Asia and the Spruce Grouse (*Falcipennis canadensis*) of America. These last two species seem to be especially close to one another as regards plumage, courtship, ecology and some other aspects, and clearly constitute a superspecies. On the other hand, the Blue Grouse is quite distinct, above all with its inflatable cervical sacs, which the other two species lack, and notable differences in the plumage of the chicks. This rearrangement into two genera has generally been well received and seems likely, in time, to receive fairly universal acceptance.

The genus *Lagopus* is not very far removed from these three species and also shares various of their primitive features. It is characterized by a special moult sequence with the plumage white in winter, by relatively small size, and by the occupation of open habitats of the Arctic or high mountains. There are three species, two of which, the Willow Grouse (*Lagopus lagopus*) and the Rock Ptarmigan (*Lagopus mutus*) are the only tetraonid species distributed throughout the Holarctic, while the third, the small White-tailed Ptarmigan (*Lagopus leucurus*), is found only at alpine altitudes in the mountains of western North America. The race *scoticus* of the Willow Grouse was long considered a different species, the Red Grouse. It is confined to the British Isles and is distinctive, among other things, in that its plumage does not change to white during the winter.

The Palearctic genus *Tetrao* was formerly divided into two genera, *Tetrao* (capercaillies) and *Lyrurus* (black grouse), each of them containing two very similar species. The capercaillies are forest dwellers of considerable size, with a western and an eastern representative, the Western Capercaillie (*Tetrao urogallus*) and the Black-billed Capercaillie (*Tetrao parvirostris*) respectively. They were probably separated during the Ice Ages, but their ranges now overlap over a large zone of the Yenisey Basin, where interbreeding often results in hybrids, evidence that their reproductive isolation is incomplete, despite the fact that their courtship rituals are quite different. The two forms of black grouse also clearly constitute a superspecies: they are smaller birds than the capercaillies and are found in more open habitats. The Eurasian Black Grouse (*Tetrao tetrix*) is wide-

spread, while the Caucasian Black Grouse (*Tetrao mlokosiewiczzi*) is the result of an isolation in the Caucasus probably dating back to the Pleistocene. As well as in size and habitat, these two species pairs differ mainly in the plumage of the males, particularly in the characteristic lyre-shaped tail of the black grouse. However, in other aspects they are very similar, for example in breeding behaviour, and cases of hybridization between the Western Capercaillie and the Eurasian Black Grouse are so common that the hybrids even have vernacular names in certain countries, for instance "rakkelfugl" in Sweden and "rackelhahn" in Germany. In fact, it has been suggested that the differences in male plumages could be interpreted largely as mechanisms of reproductive isolation, relatively recent developments aimed precisely at preventing hybridization between these two sympatric and genetically very close species.

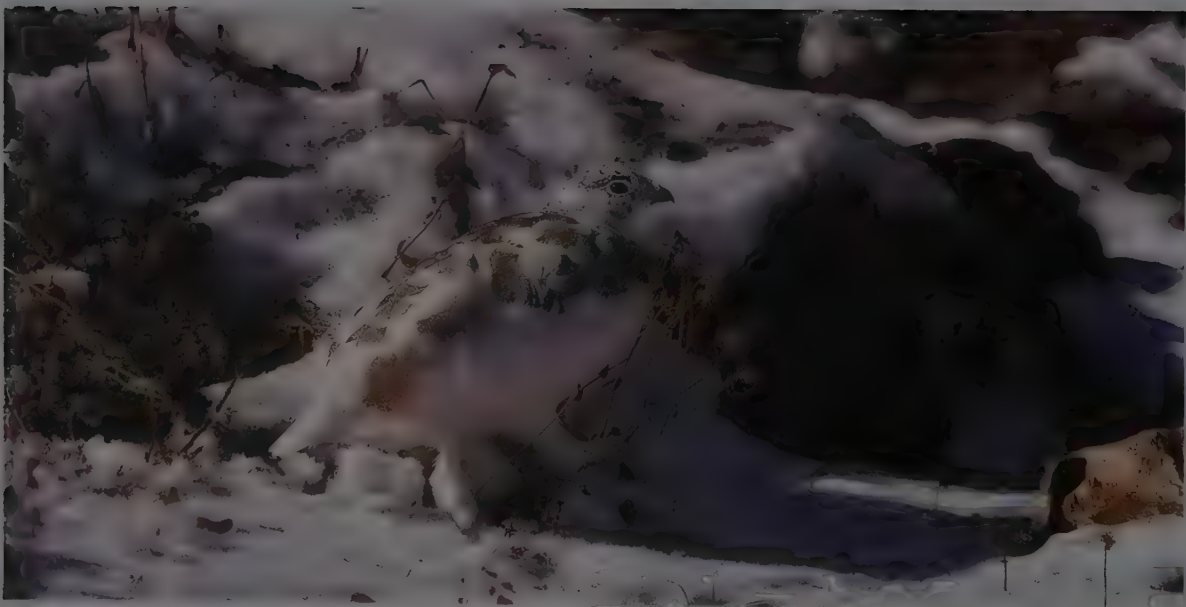
The genus *Bonasa*, previously treated as monotypic and endemic to North America, in the form of the Ruffed Grouse (*Bonasa umbellus*), now includes two other, Eurasian species that are also small and occur in broad-leaved or mixed forests. Previously, the widespread Hazel Grouse (*Bonasa bonasia*) and the very similar Severtsov's Grouse (*Bonasa sewerzowi*) of the mountains of central China were placed in the genus *Tetrastes*. Severtsov's shows the more primitive features, at any rate in its plumage, which is not very different from that of the Siberian Grouse. On the other hand, the Ruffed Grouse is quite distinct, especially with its thick ruff in both sexes, and this species may represent a fairly recent divergence, for which reasons many authors prefer to maintain the separate genera *Bonasa* and *Tetrastes*.

Ecologically, the remaining species of grouse are characterized by a general adaptation to open habitats dominated by herbaceous plants, often in dry temperate climates. They are all confined to North America, while in Eurasia the equivalent niches are occupied by the bustards (Otididae), a family with which they share some adaptive convergence. The genus *Centrocercus* contains only one species, the Sage Grouse (*Centrocercus urophasianus*), a large bird of very distinctive appearance, and probably the most specialized member of the whole family. It seems to be most similar to the Blue Grouse, in features such as the plumage of chicks and some aspects of courtship.



The three species of the genus *Lagopus* provide one of the clearest examples of cryptic plumage in the whole of the bird world. They undergo three annual moults, one more than other grouse, and these prepare the way for three seasonal plumages, which very effectively adapt and maintain the protective function of the plumage throughout the course of the year. Even the transitional phases that appear during moults normally coincide with periods when the birds' surroundings are also changing, so that the cryptic function is perfectly continuous. The most singular of the three plumages is that worn in winter, when the birds mostly inhabit areas that are blanketed over with snow. The White-tailed Ptarmigan is completely white during winter, apart from its dark eyes and black bill and claws. The winter plumages of its two congeners are also mainly white, but their tail feathers remain predominantly dark.

[Above: *Lagopus leucurus altipetens*, Colorado, USA. Photo: Bob & Clara Calhoun/Bruce Coleman]



Below: *Lagopus leucurus leucurus*, Alberta, Canada. Photo: Hålle Flygare/Bruce Coleman]

The genus *Tympanuchus* includes three species, the Greater Prairie-chicken (*Tympanuchus cupido*), the Lesser Prairie-chicken (*Tympanuchus pallidicinctus*) and the Sharp-tailed Grouse (*Tympanuchus phasianellus*). The first two are allopatric, although their ranges almost meet, and they are so alike that there is considerable dispute as to whether or not they should really be treated as separate species. The Lesser Prairie-chicken is a little smaller and paler, and the cervical sacs of the male are reddish as opposed to yellowish in the Greater, while the song is somewhat sharper and quicker. The Sharp-tailed Grouse, previously placed in the genus *Pedioecetes*, is clearly related to its two congeners, sharing features of adult and juvenile plumage, and also of courtship. It frequently interbreeds with the Greater Prairie-chicken, producing fertile hybrids. In terms of morphology, it is perhaps the most generalized or primitive form of the three.

Taken as a whole, there is no doubt that the grouse form a homogeneous group, especially if one ignores the adornments of males in some of the polygynous species. Almost all females are very similar. The frequency with which hybrids appear in

nature between the forms that live in sympatry is further proof of this close relationship. In addition to the aforementioned crosses of the Western Capercaillie with the Black-billed Capercaillie and with the Eurasian Black Grouse, and that of the Sharp-tailed Grouse with the Greater Prairie-chicken, occasional hybridization between the Blue Grouse and the Spruce Grouse and between the Willow Grouse and the Rock Ptarmigan are recorded, as well as at least ten other combinations between species of different genera. The most frequent crosses are between the Willow Grouse and the Eurasian Black Grouse, known by the popular name of "Rype-orre" in Scandinavia.

Authors seem to agree on locating the forest genera and particularly *Falcapennis* near the evolutionary base of the group. It has been postulated that such an origin, undoubtedly stemming from primitive Phasianidae, could have been connected with the development of the so-called flora of the Turgai in the Northern Hemisphere, where deciduous forests progressively substituted tropical forests during the Tertiary. The grouse could then have become separated from the Phasianidae by means of a change in diet that allowed these sedentary birds to survive during the

The Rock Ptarmigan in summer plumage (above), and the Willow Grouse in autumn plumage (below), complete the illustration of the efficiency of protective plumage in the genus *Lagopus*. In these two species, some populations from islands or more southerly parts of their respective ranges, where snow is much less permanent, moult into their winter plumage later and retain a greater or lesser number of brownish feathers, which make their plumage more cryptic in the particular areas they inhabit. The most striking example of this is offered by the British race *scoticus* of the Willow Grouse, the well known Red Grouse, which never develops white winter plumage.

[Above: *Lagopus mutus captus*, north-east Greenland. Photo: Olivier Langrand/Bruce Coleman.

Below: *Lagopus lagopus alascensis*, Denali National Park, Alaska. Photo: John Shaw/NHPA]



winter, when they took to feeding on the buds and catkins of poplars, alders, birches and other deciduous trees. In such a case the genus *Bonasa*, almost as generalized as *Falcipennis* but essentially of deciduous forests (see Food and Feeding), is probably closest to the primitive form. Later, as the taiga expanded during the Pliocene, a period characterized by a general cooling of the climate, the genus *Tetrao* may have developed, with its adaptation to the winter consumption of conifer needles. Also in the same period, or perhaps in the even colder Pleistocene, the genus *Lagopus* may have appeared in the areas north of the forest limit. Finally, the two genera that seem the most specialized, *Tympanuchus* and *Centrocercus*, probably evolved independently at the same time as arid and deforested areas expanded in North America, towards the end of the Tertiary.

The intraspecific taxonomy of this group deserves special mention for its remarkable complexity. Although the grouse are characterized by having very few, rather similar species, their average degree of subspeciation is very high. This is related to their sedentary tendencies and the extensive ranges of many species: limited capacity of dispersal and sizeable territories

together combine to cause a reduction in the intensity of gene flow. On the other hand, although the habitat of these birds typically covers vast extensions in northerly latitudes, further south they occur in small pockets, the further south the smaller, usually coinciding with mountainous regions. As illustrated by numerous bone remains, the climatic vicissitudes of the Pleistocene imposed alternate expansions and contractions of the ranges of these birds, and northward retreats led to the formation of disjunct southern populations.

A result of this is the characteristic pattern of subspeciation in the Tetraonidae: in northern latitudes, over fairly continuous distributions they show clinal variations that make it extremely difficult to recognize valid subspecies, which in any case invariably encompass broad areas of intergradation; in the south, however, the isolated satellite populations can generally be given subspecific denominations fairly easily. The two species of Holarctic distribution, the Willow Grouse, with more than 20 proposed races, and the Rock Ptarmigan, with more than 30, offer extreme examples. In both cases the northern races are relatively few and doubtfully distinct, while a wide array

of valid subspecies occupy the southern confines of their ranges. Thus, in the Rock Ptarmigan, in the whole circumpolar belt there are six or seven races, which for some authors could well be grouped into two or three given the very slight variations, in contrast to the numerous, distinctive races resident in Scotland, the Pyrenees, the Alps, various mountain ranges of central Asia, Kamchatka, the Commander Islands, the Kuril Islands, Honshu, the Aleutians (with at least half a dozen races), Newfoundland, Greenland and Iceland.

The other species with relatively wide distribution also have quite a few geographical races: in Eurasia, the Hazel Grouse has some 12 subspecies, the Eurasian Black Grouse 7 and the Western Capercaillie 12; and in America, the Blue Grouse has 8, the Spruce Grouse 6 and the Sharp-tailed Grouse also 6. At the other extreme, up to five species of more or less restricted distribution can be considered monotypic: the Caucasian Black Grouse, the Siberian Grouse and Severtsov's Grouse in Eurasia; and the Sage Grouse and the Lesser Prairie-chicken in North America. However, while the recognition of subspecies is usually rather a subjective business, in the case of Tetraonidae there are even greater complications. Scientific descriptions have often been based on only slight variations, in many cases gradual, of size or colour, complicated by considerable individual variation and sometimes by colour morphs, as in the Ruffed and Hazel Grouse, or complex moult sequences, as in *Lagopus*. Therefore, it is not surprising that some taxonomists have opted to reduce the number of subspecies quite drastically. C. Vaurie, for example, accepted no more than three or four in the Western Capercaillie, and only four in the Hazel Grouse.

Morphological Aspects

The external appearance of the grouse does not separate them much from most other Galliformes, and, in fact, the smaller species are often popularly called "partridges", the larger ones "cocks" or "hens" and *Tympanuchus* "prairie-chickens". They are relatively plump, compact birds, with the bill, neck, wings and legs all short; the tail varies from short in *Lagopus* to moderately long in *Tetrao*.

Overall length ranges from roughly 30 cm to 90 cm. The smallest species belong to the genera *Lagopus* and *Bonasa*, and the largest to *Centrocercus* and *Tetrao*. The lightest species is Severtsov's Grouse, with some males weighing about 280 g and females around 260 g; only a little heavier is the White-tailed Ptarmigan, with both sexes weighing about 325 g. At the opposite end of the scale, the Western Capercaillie reaches weights of 5 kg and up to 6 kg in some populations, although only in males, as females rarely exceed 2 kg. This extreme dimorphism, also found in the genera *Centrocercus* and, to a lesser extent, *Tympanuchus*, is related to some peculiarities of the breeding behaviour, for it is typical of the polygamous species. On the other hand, in the monogamous genera *Lagopus* and *Bonasa* males and females are roughly the same size and weight.

Plumage is dominated by brown or grey tones and barred, spotted or scaly patterns. This clearly serves a cryptic purpose, and is typical of "prey species" such as the grouse. One of the most notable examples of such protective coloration can be seen in the genus *Lagopus*: with their three seasonal plumages and the transitional phases caused by moults, they manage to maintain excellent camouflage throughout the whole year in the variably snowy environments they inhabit.

Only the males of the genus *Tetrao* depart somewhat from this cryptic norm, with their shiny black plumage. However, much of the phaneric effectiveness of these plumages is based on the ritual exhibition of certain white areas or spots that normally remain hidden, or are not conspicuous, when the bird remains still in the semi-darkness of the forest, with its tail and wings folded. It is perhaps in order to compensate for the comparative modesty of their plumage that the Tetraonidae have brightly coloured earlobes or combs over their eyes. These combs are almost hidden by the feathers in young birds, and most of the time in females. They develop mainly in adult

males, especially during the breeding season. During courtship displays they fill with blood, which makes them swell up, sometimes so much so that the two sides almost meet over the bird's crown. The colour intensifies, often changing from yellow or orange to bright red. Males in the genera *Dendragapus*, *Centrocercus* and *Tympanuchus* also have very specialized cervical sacs, which are normally hidden under the plumage, but which can be inflated through the oesophagus to an extraordinary degree. During courtship, their colour also intensifies, due to a special flow of blood.

Also connected with mimetic functions are the colour morphs found in the genus *Bonasa*; despite a fair range of tones, there are two basic types, grey and red. In both the Hazel Grouse and the Ruffed Grouse the grey morph is commoner in the more northerly, colder parts of the range, while the red morph dominates in the south, which may be connected with the different background colours in the predominant vegetation of the two zones. For example, in a forest in Minnesota (USA) it was found that there was a relationship between the proportion of birds of the different morphs and the presence or absence of nesting Northern Goshawks (*Accipiter gentilis*): the red morph, which normally appeared in a very small minority of birds in the area, increased to 55% of the population during a period of nine years when there were no goshawks, only to drop again as soon as the goshawk re-established itself, when differential predation was clearly detected.

On hatching, the chicks, precocious and very similar in all respects to those of Phasianidae, also have extraordinarily cryptic plumage. The pattern of alternate pale and dark patches on the dense covering of down is also of some taxonomic interest. For example, one of the reasons for the Blue Grouse being placed in a different genus from the Spruce Grouse is that, while the plumage of the latter's chicks is very similar and obviously related to that found in *Lagopus*, that in the Blue Grouse is very different, and is similar to the plumage of Sage Grouse chicks.

The plumage of the Tetraonidae is also remarkable for its density and relative heaviness: an adult Hazel Grouse's plumage can suppose up to 22% of its total body mass. Undoubtedly, this is connected with a general adaptation to cold climates. Although down, as such, is not very frequent, the contour feathers have a broad down-like base and a highly developed aftershaft, both undoubtedly developments to help in thermal insulation; the aftershaft is much longer in winter than in summer. Furthermore, in the white winter plumage of *Lagopus*, the barbules have numerous peculiar vacuoles, air-filled cavities, that seem to be used for increasing insulation capacity by creating a kind of "greenhouse effect", although it has also been suggested that they could be useful for increasing the resemblance of the plumage to snow.

Both the nostrils and the tarsi are feathered. Related with the first is the lack of the membranous lid or operculum that is so characteristic of the other Galliformes. The tarsus, except for a thin strip down the back, is normally completely covered with feathers down to the base of the toes, and in *Lagopus* even the toes are feathered, as a substitution for the pectinations of the other Tetraonidae; toe feathering is probably the more recent development, as rudimentary pectinations remain in the White-tailed Ptarmigan. This feathering of the feet, much denser in winter than in summer, is the origin of the generic name, coming from the Greek *lagos*, meaning "hare", and *pous*, "foot". More than anything else, it seems to help the birds walk on the snow, in conjunction with the long toes, and claws that are almost twice as long in winter as in summer, for example 17 mm as opposed to 9 mm in the Willow Grouse. It has been calculated that each cm² of foot area corresponds to 15 g of body weight in the Willow Grouse, but to some 40 g in the rather lighter Grey Partridge (*Perdix perdix*). Experiments comparing the normal feathered feet to those without feathers have shown that the winter plumage increases the surface area of the foot by four times, and reduces sinkage into the snow by half, which must obviously result in an important saving in energy.

The digital combs of the other Tetraonidae are perhaps less effective in this respect: in the Ruffed Grouse a surface area of

Of all the North American tetraonids, the Spruce Grouse is the most closely associated with conifer forests, to such an extent that its range roughly coincides with the conifer belt that stretches right across the continent. Despite its vernacular name, this species is not limited to spruce forest, but is also found in fir and especially pine woods. Connected with this habitat preference is the fact that the Spruce Grouse is one of the tetraonids best adapted to both perching and moving about on branches of trees.

[*Falcipecten canadensis*
canadensis,
Saskatchewan, Canada.
Photo: Wayne Lynch/DRK]



7.6 cm² has been calculated with pectinations, as opposed to 6.5 cm² without them. These pectinations are rows, sometimes double, of blunt-tipped horny appendages, 2-3 mm long, on either side of each toe. They are shed in spring and reappear during the autumn, and are thus present mainly in winter. It has been suggested that perhaps their main function is to help excavate the burrows under the snow that the birds use as thermal refuges. Their relationship with the snow could, however, be less direct: the snow forces most of the species, except the three *Lagopus*, to get by on a diet of almost exclusively arboreal source. The main use of the pectinations could therefore be to help the birds grip the branches, compensating to a certain extent for the limitation caused by having the hallux short and raised above the other toes, as in the Phasianidae but in contrast to the Cracidae. The pectinations would be a nuisance for walking in summer, when the birds feed on the ground, very often in low, dense vegetation, for example heather (*Calluna*, *Erica*). It is also indicative that in the most southerly forms, the Lesser Prairie-chicken and the race *attwateri* of the Greater Prairie-chicken, the winter combs hardly develop at all.

Moult is on the whole very similar to that in other Galliformes. Adults go through a partial pre-breeding moult in spring and a complete moult in summer, once breeding has been completed. In the latter, males begin earlier than females, sometimes a good deal earlier, as also do females that have not succeeded in rearing chicks. Primary moult is descendant, with the innermost dropping first; the rectrices are replaced centripetally, from the outermost inwards. Young birds go through a very early summer moult, two to four weeks after hatching, in connection with the precocious development of the flight-feathers. This post-juvenile moult is almost a complete moult, but the two outermost primaries, are retained until the complete moult of the following year, and, as they can easily be distinguished from the other primaries, they are very useful for helping to determine the age of trapped birds. Apart from this, young birds after their first winter usually resemble adults closely.

The members of *Lagopus* also go through another partial moult, sometimes known as the supplementary moult, beginning towards the end of the summer or in autumn, almost immediately after the complete post-breeding moult, and con-

tinuing until well into the winter. In this moult, the brown contour feathers are substituted by totally white feathers, until little by little the characteristic pure white winter plumage appears. There are, however, some exceptions. To the well known example of the Red Grouse one can add some other races that live on relatively southerly islands where the snow does not lie for long periods, for instance the Rock Ptarmigan's race *gabrielsoni* of Amchitka Island in the Aleutians, or its race *millaisi* of Scotland, as well as the race *variegatus* of the Willow Grouse inhabiting certain islands off the coast of Norway. In all these cases, moult begins later than normal, and, moreover, pigmented feathers are retained, with the result that the winter plumage is relatively pigmented rather than pure white, and thus a lot more cryptic, given the local environment. In the last of these cases, that of the Willow Grouse off Norway, it seems that the phenomenon has taken place independently on three islands, which certainly questions the validity of the subspecies in which they are all grouped. Salomonsen pointed out long ago that individuals of the Rock Ptarmigan in Newfoundland also failed to complete the winter-autumn moult if they were moved further south.

Apparently, when subjected to sudden stress, grouse can on occasions drop a whole patch of contour feathers, a phenomenon called "fright moulting". This has been recorded in many of the Eurasian and North American species, particularly in incubating females, and it may have adaptive value by allowing individuals, momentarily seized by predators, to escape, in a manner similar to that of lizards losing their tails.

Like other Galliformes, grouse have comparatively short, rounded wings, with a low aspect ratio. With 10 primaries and 15-21 secondaries, their wings fit well with the type known as "elliptical", a form useful for reaching great speeds very quickly, but with high energy investment. As in partridges, flight begins with a strong, noisy take-off, and continues with a series of rapid, rather mechanical wingbeats that alternate with fast glides on down-curved wings. Rapid take-off is an obvious mechanism for escaping from predators, and makes them, like pheasants and partridges, especially attractive to hunters. Such rapid take-off is possible due to the well developed pectoral musculature with the prevalence of white muscle fibres, which allow more intense sudden bursts of effort. The great mass of

muscle and white flesh also undoubtedly increase the value of the birds to hunters. However, these white fibres cause rapid exhaustion, so flights are typically short, as the birds soon tire. For example, it is said that if Ruffed Grouse is made to fly distances of not normally more than 100-200 m four times in quick succession, it becomes so exhausted that it is possible to catch it by hand.

Although in general grouse are reluctant to take flight, there is a certain gradation in flying ability, which improves somewhat in species of open areas. Those genera that inhabit forests, *Falcapennis*, *Dendragapus*, *Bonasa* and some *Tetrao*, hardly fly at all in their daily routine apart from occasionally to ascend or descend from trees in relation to feeding, resting or courting. In these cases it is certainly surprising the ease with which they can ascend vertically, as if in a single leap, an ability that they often incorporate in their displays in the so-called "flutter-flights". When they are surprised on the ground they usually escape by flying, but normally only to a nearby tree, where they remain still, relying on their camouflage, a strategy which many people understandably interpret as a sign of stupidity. On slopes they tend to drift downhill by flying, but normally regain higher ground by walking. It is rarely possible to see them fly above the trees, as they prefer to escape by dodging the trunks and undergrowth at medium height. In this respect they are certainly skilful, as the short wings and long tail allow easy manoeuvring, even for heavy male capercaillies. The black grouse, which are far less tied to forests, fly better than their larger relatives and can cover relatively long distances with a single straight flight, sometimes fairly high, in which a bird may glide for considerable distances with its wings spread. In Kazakhstan birds regularly move like this from the steppes to the forests, travelling distances of up to 30 km in each direction, and similar movements of some 11 km without resting have been calculated for the Greater Prairie-chicken between patches of habitat. The members of *Lagopus* also tend to be better fliers, although they normally prefer to escape on foot. The Rock Ptarmigan is especially agile in the air, and a great deal of its territorial activity is based on repeated demonstration flights, which sometimes cover 400-500 m.

There is also a wide range in abilities for terrestrial or arboreal locomotion in the different Tetraonidae. The *Lagopus* species are capable of running, with neck outstretched, back hunched and tail down, at speeds that have been compared to those of a horse trotting or of a sledge being pulled by reindeer, but their ability in trees is practically nil. At best, Willow Grouse can reach some of their food clambering clumsily among the lower branches of small birches or willows. On the other hand the Spruce Grouse, Blue Grouse and capercaillies move very well in the canopy, using their long tails to help them balance, while they move along the branches or jump from one to another, ascending spirally round the trunk. But even the most arboreal Tetraonidae, such as the small *Bonasa*, become mainly or exclusively terrestrial during almost half the year, from spring to autumn, and they are all therefore capable of walking on the ground fairly well, from the clumsy capercaillie, that generally prefers to avoid possible obstacles, to the adept Hazel Grouse, which with great ease jumps over fallen trees or makes its way through dense shrubbery.

The bill is even shorter, more robust and more curved than those of other Galliformes. The upper mandible, with a strongly convex culmen, generously covers the end of the maxilla. This type of bill, reminiscent of secateurs, is perfectly adapted to the herbivorous, mainly browsing diet that is typical of the Tetraonidae. Grouse consume mainly buds, leaves, twigs and small fruits and berries, rather than the seeds on which pheasants regularly feed. However, members of the genus *Tympanuchus*, the only insect- and seed-eaters in the family, have relatively long, slender bills, similar to those of domestic fowl and pheasants. Apart from this, there are few obvious differences between the bills of the various species, except in size.

On occasions, however, relatively small variations in the shape or length of the bill help to demonstrate the ecological segregation of different species in areas of sympatry. The most notable case is perhaps in Alaska, where during winter the three

species of *Lagopus* often coincide in the same zones: the Rock Ptarmigan, with its comparatively thin bill, is obviously the best adapted for taking the 2-5 mm long catkins and the dwarf birch buds that constitute its staple diet; the deep, broad bill of the Willow Grouse corresponds to a diet of mainly willow buds 5-15 mm long and even bigger twigs; and the White-tailed Ptarmigan, with its intermediate bill, eats large alder catkins, but also when possible those of birch and willow. On the other hand male Western Capercaillies have very large bills, that are proportionally much larger than those of females. This is not connected with sexual differences in diet, but rather with breeding behaviour: the bills are the males' principal weapons in their fights for territories and females, and, as they are conspicuously pale, they also have special value in visual signalling during courtship. This does not, however, seem to be the case, or at any rate it is less important, with its congener, the Black-billed or Small-billed Capercaillie.

The grouse's diet of plant matter, or more precisely of leaves, is fairly exceptional in the bird world; because of their very high metabolism and the lightness necessary for flight, birds tend to consume only food with a very high energy content, such as animal prey or seeds. However, the feature that best characterizes the grouse ecologically, especially in comparison with the pheasants, is their capacity to survive the winter by feeding essentially on the leaves and buds of trees, which, although easy to obtain, are very fibrous and have a very low calorie and protein content. They save a remarkable amount of energy during the winter, on the one hand because they hardly move at all, apart from the bare minimum that is absolutely necessary for feeding, and on the other hand because they shelter in tunnels under the snow (see General Habits).

Even so, a fundamental component of their adaptive strategy consists of taking maximum advantage of their relatively unnutritious plant food, especially during winter, and some of their morphological adaptations are essential for this. The most important is the comparative length of their intestines, especially of the caeca. Already in the 1950's, A. Leopold showed that in the partridges (*Perdix*, *Alectoris*) the caeca measure some 17 cm, whereas in grouse, which are only slightly larger, they reach 44 cm long on average. In fact, compared to the remainder of the intestine, the caeca measure 60-140% of its length in grouse, depending on the species, as opposed to a maximum of 50% in the pheasants, and only 35% in quails. In addition, at least in some species, gut length varies seasonally with the diet, for example in the Spruce Grouse, being some 40% larger in winter than in summer. Also, the caeca of these birds show highly developed internal crests, which greatly increase the total surface area. These are undoubtedly of immense importance for grouse, as a well developed flora of symbiotic bacteria help to break down the cellulose and thus get the best out of the plant food, as happens in the stomachs of ruminants. The caeca also carry out some food selection, so that the excessively fibrous particles in the chyme carry on through the thick intestine, while the more nutritious ones pass into the caeca to allow more time for digestion. It is quite easy to distinguish the normal or "intestinal" droppings that are deposited at short intervals throughout the day (about every six minutes in the Spruce Grouse), from the "caecal" droppings, which are larger and softer and are expelled every 24 or 48 hours, generally early in the morning.

Another function of the bacterial fermentation that takes place in the caeca is the provision of an additional endogenous heat source, which has been calculated as 11% of the basal metabolic expenditure in the case of the Willow Grouse. Lastly, it has been suggested that the caeca may recycle nitrogen from the uric acid in the urine that reaches them by retroperistalsis, starting from the cloaca. Therefore, not surprisingly, it has been possible to find a direct proportional relationship between the size of the caeca and the comparative length and harshness of the winters that each grouse species has to live through, or even between different populations within the same species.

The crop and the gizzard are also comparatively well developed in grouse. The ample crop allows them to store a great deal of food in a short time, and, as this is normally obtained

The sociability of grouse varies considerably from species to species.

Forest-dwelling species tend to have more solitary habits, whilst some of the species that live on open plains are conspicuously gregarious. The Rock Ptarmigan and its two congeners occupy an intermediate position. They breed territorially, but in autumn and winter form flocks which may contain up to 300 birds. The largest gatherings normally take place during exceptionally cold spells.

[*Lagopus mutus rupestris*,
Churchill, Manitoba,
Canada.

Photo: M. Macri/FLPA]



quite easily, they can therefore quickly retreat to a resting place hidden from predators. The crop of the Blue Grouse, for example, can store at least 45 g of pine needles, which is approximately half of the necessary daily intake. For this reason, two main feeding sessions per day are usually enough, one at daybreak and the other at nightfall, and the crop and the caeca complement each other so as to assure almost continuous digestion and therefore a fairly constant production of energy day and night, obviously a great advantage in cold climes. The gizzard also adapts itself to the necessities of the season, growing by as much as 75% in volume during winter, in the case of the Spruce Grouse. With an adequate load of grit, the extraordinarily muscular walls can grind into minute particles the fibrous winter food, which is quite different from the relatively tender leaves and berries taken in summer. Grit is so necessary during winter that in certain areas and years of heavy snow birds can apparently die if the grit wears out before the snow allows them to collect a fresh supply. In consequence, birds have to stock up well in grit during the autumn, and in the Western Capercaillie one study in Russia found average contents of 630-1230 stones in autumn, as opposed to only 230-300 by the end of winter.

As with the shape of the bill, the organs of the digestive apparatus are subtly adapted to the feeding preferences of the different species, thereby helping to indicate different ecological niches. In the aforementioned example of the genus *Lagopus* in Alaska: the Willow Grouse, which feeds on willow twigs and buds in winter, has a large gizzard and a relatively short intestine; the Rock Ptarmigan, which feeds on birch catkins and buds, has a long intestine and a small gizzard, in accordance with its softer, but also less nutritious, food; and finally, the White-tailed Ptarmigan, which has a variable diet, but which is generally satisfied with the hard, resinous, cone-like alder catkins that are rejected by other species, has both the intestines and the gizzard proportionally much more highly developed.

Habitat

A major ecological feature of the Tetraonidae is their perfect adaptation to cold climates. A series of morphological, physiological and behavioural adaptations allow them to thrive in environments of enormous seasonal change without resorting to long distance migration as other birds do. They are particu-

larly capable of surviving during the long, severe northern winters on a poor and limited diet, consisting basically of conifer needles or the buds of deciduous trees, almost the only vegetable food available above the frozen cap of snow.

This is, indeed, the basic difference between them and their relatives the Phasianidae, and explains how they are able to replace them ecologically in northern latitudes. Apart from this, there are no fundamental distinctions between the two groups, and grouse occupy the same wide range of terrestrial habitats as the phasianids, from densely forested to wide open areas. One possible difference lies in the extraordinary simplicity that characterizes the northerly ecosystems, with their monotonous homogeneity throughout enormous expanses of Eurasia and North America. Two aspects connected with the same question are the low number of grouse species and the vast ranges of most species.

Arctic or alpine tundra is the characteristic environment of the genus *Lagopus*. The two species with circumpolar distribution, the Rock Ptarmigan and the Willow Grouse, have different ecological requirements: the former, almost always scarcer and more localized, is adapted to the hardest and most demanding Arctic conditions, with rockier and more poorly vegetated substrate; the latter generally occupies more southerly areas or lower altitudes, usually with willow or birch undergrowth, often below the tree-line, penetrating into clearings in boreal forests and even into cold steppes, as far south as Kazakhstan. Only in Alaska and eastern Canada does the range of the White-tailed Ptarmigan overlap with that of its two congeners, and there it always occupies the highest parts of the mountains. In Eurasia, it is the Rock Ptarmigan that inhabits the high mountain habitats, from the Pyrenees to the Japan, although it is missing in most of the intermediate mountain chains, from the Carpathians and the Balkans to the Himalayas. Because of this, the recent discovery of what seems to be a tiny population in the Pamir Mountains of Tadjikistan, living at altitudes of up to 4000-5000 m during the summer, has been greeted with great excitement. In the Altai and other mountains of central Asia, the Rock Ptarmigan and the Willow Grouse occur alongside, but with the expected altitudinal segregation. However, in those areas where only one of the two occurs, habitat preferences tend to be broader, probably due to the lack of competition. Thus, in the New Siberian Islands the Willow Grouse lives in very bare Arctic areas, while in the Commander Islands the Rock Ptarmigan colonizes valley bottoms and meadows with long grass.



Scratching the head with a foot, dust-bathing and above all preening are some of the diverse comfort activities carried out by the Ruffed Grouse, and by nearly all members of the Tetraonidae, during the lengthy periods of the day which they dedicate to resting. When foraging, this species is able to fill its crop with buds very quickly, thus ensuring that feeding occupies only very brief periods. This is of importance because foraging activity, with its associated movement and noise, renders the species more exposed to the possibility of predation.

[*Bonasa umbellus*.
Photo: Leonard Lee Rue/
Bruce Coleman]

In the somewhat more numerous forest species, a clear division of habitat preferences is also visible, although there are relatively wide bands of overlap between species. Both in Eurasia and North America it is possible to order these preferences according to the different stages of forest succession. The capercaillies are related to climax forest types in Eurasia, the Western Capercaillie being most closely associated with taiga of Scots pine, and the Black-billed Capercaillie with larch taiga in Siberia. The case of the Siberian Grouse is similar, as the species is tied to the spruce and fir forests fringing the Sea of Okhotsk. In America, the boreal conifer forest is mostly occupied by the Spruce Grouse, which, in spite of its name, depends more on pine than on spruce. The Blue Grouse is also linked with coniferous forests, but above all in mountainous areas and mainly during the winter, since for breeding it prefers to use a variety of habitats, often very open ones. The species of the genus *Bonasa* also occupy very diverse forest types, although they show a marked preference for mixed coniferous and deciduous woods, and also for forests in relatively early stages of development. Not a lot is known about Severtsov's Grouse, but for both the Hazel Grouse of Eurasia and the Ruffed Grouse of America, the presence of small, fairly dense groves of deciduous trees like aspens, poplars, birches and alders is very important.

The black grouse are clearly ecotone birds, characteristic of the transition zone between forest and steppe, moor, heath or mountain thicket, with the Eurasian Black Grouse distributed over an enormous area in very varied types of forest and the Caucasian Black Grouse in a relatively narrow belt in the mountains of the Caucasus, concentrated along the tree-line. To a certain extent an ecological equivalent in North America is the Sharp-tailed Grouse, although in some areas it is even less dependent on trees, and is perfectly at home in prairies with minimal shrub cover.

The fourth and last ecological group in the Tetraonidae is found only on the plains of North America. The Sharp-tailed Grouse serves as a prelude to the other species of *Tympanuchus*, the prairie-chickens, that occupy the wide belt of grasslands in the Mid West. It seems that originally the Greater Prairie-chicken depended to a certain extent on oak forests or small woods, at least during the winter, but nowadays it is closely associated, like the bustards in Europe, with the mosaic of cultivation and small patches of grassland that occupy the old prairies. The Lesser Prairie-chicken is found in the rough con-

tinuation of this same habitat towards the south-east, in somewhat drier and warmer climates. Finally, the impressive Sage Grouse lives even further west, in a special cold dry shrub-steppe, characterized by the abundant presence of shrubs of the genus *Artemisia*.

General Habits

Grouse, in particular the forest species, are generally very unobtrusive birds, that remain well hidden and difficult to observe. Their behaviour, like their plumage, is fashioned to avoid predation as far as possible. Therefore, although they are basically diurnal birds, they usually concentrate on foraging when there is less light, at dawn and around dusk, and they spend the remainder of the day still and silent in well concealed spots. They use this time in plumage care, spending long periods preening, especially during moult. Dust-bathing is also frequent in various species, particularly during the summer, sometimes not on dry soil but on anthills, or in the wood chips left over from rotten tree trunks, but bathing in water seems to be very rare or even unknown.

Given the nature of their food (see Food and Feeding), feeding periods are typically very brief. The Ruffed Grouse, for example, without moving from one aspen, and with a rhythm of as many as 47 pecks per minute, can fill its crop with buds in just 15-20 minutes. At the other extreme is the genus *Lagopus*. In Sweden, the Willow Grouse has been calculated to forage for about six hours daily during winter, when it has to walk on the snow in search for birch buds at accessible heights, not always an easy task. On the whole, with one or two hours' foraging a day, most species can find enough food, at least during the winter, when the staple food is very simple. At other times of the year, when quality is perhaps more important than quantity, rather more time tends to be spent on feeding. In the Rock Ptarmigan in the Alps, feeding time was calculated at a daily total of four hours in midwinter, as opposed to six hours in May. Growing chicks, too, naturally spend far more time daily in feeding than adults, and they tend to feed throughout the whole day.

Feeding time is split between morning and evening, depending mainly on the comparative duration of day and night, which is extremely variable in northerly latitudes. Apparently, birds generally attempt to have some reserves in the digestive

tract at all times, and the quantity they eat at any particular moment depends on when the following feed will be. In the case of the Willow Grouse in Sweden, at 62° N, and at the end of January, two hours of foraging were registered in the morning, from 7:00 to 9:00 hours, as opposed to four hours in the afternoon, from 13:30 to 17:30 hours. Of course, at some latitudes the days are so short in winter that the birds use all the available daylight hours for feeding, and only later on does their feeding schedule again become bimodal, as in the cases of the Western Capercaillie in Finland, and *Lagopus* in Alaska. A particularly peculiar case is that of the Rock Ptarmigans on Spitsbergen, and other islands of the Svalbard group, at 77°-80° N, that do not see the light of day from the middle of November until the end of January. During the long "polar nights" the Rock Ptarmigans lose their daily rhythm, remaining continuously active.

Even while feeding, grouse remain as cautious as possible in an attempt to avoid predation. Female Willow Grouse in Norway, when moulting from white to chestnut plumage in spring, have been seen to move progressively from the snowiest areas to less snowy ones, even though this supposes changing to a diet with lower protein content, as they move from areas of willow to others of dwarf birch. In a similar way, the dark capercaillies and black grouse move to feed in the trees as soon as the first snow falls, even before the food on the ground ceases to be accessible.

Roosting and loafing areas are chosen with a view to reducing not only predation, but also as far as possible the energy costs necessary for maintaining a constant internal temperature. In steppe birds, like the prairie-chickens, these can be areas of thick, well shaded bush cover, whereas in the forest the Hazel Grouse prefers to hide behind a mass of branches in the lower part of a tree, close to the trunk. For different species of open areas, the existence of enough bushes is an important feature of habitat quality. Similarly, evergreen conifers can be very valuable during winter for species like the Hazel, Ruffed and Eurasian Black Grouse, although these species feed only on deciduous trees.

Once winter arrives, most grouse benefit from the new opportunity offered by the snow, and rest in burrows both day and night. In fact, were it not for this habit, it would be virtually impossible for them to survive in the great northern expanses where temperatures often descend to between -40°C and -50°C. At these temperatures the metabolic cost of thermoregulation is such that it is impossible to attain with the habitual low quality diet. However, inside the refuges under the snow, the temperature is about -2°C or -3°C, very near or even within the birds' range of thermoneutrality, so that an immobile bird expends practically nothing above its basal metabolic level. These refuges heat up very quickly: in the Hazel Grouse it was calculated that with a temperature of -48°C outside, the refuge reached almost 0°C in less than half an hour.

There is a certain danger that the temperature could rise too much, and the bird could get wet or the refuge collapse due to the snow melting, but to prevent this happening the grouse can open a small ventilation hole in the roof of the burrow and immediately re-establish more favourable conditions. Another potential threat is excess air humidity that could allow ice to form on the walls and impede the entrance of oxygen. It has been suggested that the feathers that cover the nostrils of grouse may serve to condense the humidity of their respiration. Also, the droppings that accumulate, besides initially creating some heat and insulating the ventral part of the body (which is also protected by the feathered tarsi), may absorb the humidity, given that their water content is extremely low, at the end of their journey through the intestines. It is interesting that they usually deposit the softest caecal droppings on top of the rest immediately before leaving the refuge in the morning.

The droppings are also useful from a practical point of view to researchers, as, due to their being expelled regularly, they can, through quantity, give a fairly precise idea of the length of time a bird has spent inside a refuge. Because of this, it is known that the use of burrows in the snow is closely related both temporally and geographically with the outside tempera-

ture. If this is only moderately low the birds spend only the night under the snow, but if it is really cold they also spend most of the day there, venturing out only as briefly as possible when it becomes essential for them to eat. On occasions, when as well as the cold there are also strong winds, they are said not to leave the burrows other than for afternoon feeding, and they may even remain inside for a couple of days. Much longer is not feasible, given the fact that they generally lack reserves of fat. An exception is the Spitsbergen race of the Rock Ptarmigan, which can acquire reserves of up to 35% of its body mass, as opposed to the maximum of 4% in the other races and species of the genus. This appears to be a clear adaptation to the climate of those islands, which in the depths of winter alternate between relatively warm periods and very cold spells when the snow freezes, restricting access to the vegetation. These fat deposits allow the birds to fast for more than 10 days; they are at their maximum in autumn, disappearing in spring.

Tunnels are dug very quickly, reputedly in about 15 seconds by the Willow Grouse, or 1 minute by the Black Grouse, although of course this depends on how hard or soft the snow is. Digging is done mainly using the feet, with their pectinations and, in *Lagopus*, the long claws they have in winter; the bill is also used, though rather little. First the bird digs vertically down, and then horizontally under the snow for some distance, normally two or three times its body length, finishing with an oval space large enough for it to stretch out in comfortably. The entrance tunnel is filled with the snow taken from farther in. In order not to leave traces, the bird normally flies a short distance to the point selected for the tunnel, or drops down to the spot from a tree. When leaving, it opens a hole directly in the roof of the chamber, sticks out its head for a moment, and then jumps out, either walking away or, especially if the snow is very soft, flying off. The thickness of the covering of snow above the chamber seems to vary between species, but in the Willow Grouse, for example, an average of 5 cm has been recorded; in one case, after heavy snow during the night, a bird moved to a second chamber slightly ahead of and above the original one, again some 5 cm from the surface.

It has been calculated that, at a temperature of -20°C, a grouse that remains under the snow saves about 20-35% of the energy it needs in order to survive. These "igloos" also serve as good hiding places from predators, although it seems that

The male Blue Grouse inflates its oesophageal air-sacs when producing its "hooting" call, one of the most characteristic elements of its territorial advertisement behaviour. A bird hoots five to seven times in fairly rapid succession, the series lasting about three seconds in all; this sequence is repeated at intervals of six to thirty-six seconds. Frequency differences have been noted between the inland and coastal races.

[*Dendragapus obscurus fuliginosus*, Glacier Bay National Park, Alaska.
Photo: Johnny Johnson/DKJ]





"Drumming" is the main system of territorial defence used by the male Ruffed Grouse. A typical "drum" consists of a flurry of strong, rapid strokes of the wings lasting five to eleven seconds, and takes place with the bird standing on a log, almost always in the same place and facing the same direction. Contrary to what has often been said, the wings do not strike the log, nor do they beat against each other, nor does the bird peck at the wood to drum. The muffled drumming sound is produced simply by air compression. In order to avoid being thrust backwards by violent beats of its wings, the bird braces its tail against the log, and clings firmly onto it with its claws.

[*Bonasa umbellus*.
Photo: J. Swedberg/Ardea]

the Great Grey Owl (*Strix nebulosa*) is an exception, with its ability to detect birds underground by means of sound location. Nevertheless, with these clear advantages, it is not surprising that most species use such burrows extensively, or that many select specific places where the snow tends to accumulate more readily during the winter, for example in forest clearings. This habit may even have favoured the evolution of some morphological features that are so characteristic of the group, such as the pectinations on the toes or the feathered tarsi and nostrils.

The different species vary considerably in terms of gregarious or solitary habits. In the genera *Falcipectus*, *Dendragapus* and *Bonasia*, it is rare to see several adults together, while at the other extreme the steppe genera *Tympanuchus* and *Centrocercus* habitually form flocks of hundreds of birds. In general, grouse are territorial and solitary birds during the breeding season, although in the species with leks, like the black grouse, the Sage Grouse and the prairie-chickens, groups of males can be seen even during this period. Such cases are all the more exceptional, given that otherwise it is the females that are generally more sociable. After breeding, which is solitary, females remain with their young for two or three months, and in various, generally solitary species, several families often join together in the autumn to form small groups. If the males do so, they tend to form a group on their own, at least those that are over a year old, and sometimes, as in *Lagopus* and the Sage Grouse, the sexes occupy different areas in winter, with males always remaining closer to the breeding grounds.

Sociability, at its height during autumn, becomes weaker throughout winter, although it is actually in exceptionally cold conditions when the largest concentrations usually occur. What with one thing and another, average group size is very variable, not only between different species, but also within the same species, according to time of year, age, sex and also geographical region, and depending on the comparative abundance of birds. For example in the Eurasian Black Grouse, the separate winter flocks of males and females normally comprise a few dozen individuals, but in certain birch forests in Siberia it has been reported that the groups reach or surpass 300-500 individuals. Perhaps the clearest function of flocks in all cases is protection against predators, due to the possibility of increased surveillance.

Voice

The repertoire of sounds produced by grouse is as wide as or wider than that of any other Galliformes, with great variability between species, sexes and ages. In particular, the profusion of non-vocal sounds in the displays of males is noteworthy. Males also use vocal sounds of several kinds, but in general it is the females that produce the greatest variety of calls, to a large extent related with breeding behaviour.

Vocal sounds are produced in the syrinx, which is of the extended tracheo-bronchial type, anatomically very similar to that of the domestic hen. The basic frequencies are the result of the different speeds of vibration of the tympaniform membranes, and they are subsequently modified, depending on the resonance qualities of the trachea and the pharynx. In general, the greater the volume of a sound tube, the lower the frequency produced, so that, for example, the larger species or fully-grown individuals are those with deeper voices, producing the lowest frequencies. Low frequency sounds are characterized by carrying farther with the same volume, which obviously enhances their effectiveness in certain aspects of territorial and sexual behaviour. In several grouse species, there are vocalizations, such as the "booming" of prairie-chickens or the "rookooing" of black grouse, that the human ear can hear at distances of 3-4 km. Another advantage of such calls is that it is more difficult for those possible predators to locate the caller. But in order to produce these types of sounds it is necessary somehow to enlarge the normal capacity of the respiratory tracts. In the Western Capercaillie, the trachea is increased in length by a third, by means of a loop at the level of the crop. More effective still is the incorporation of the oesophagus into the system of resonance, with the addition of inflatable air-sacs; in the Sage Grouse, this modification increases the total volume of the system by 25 times.

The prairie-chickens and the Sharp-tailed and Blue Grouse have similar air-sacs, which are also useful in producing visual signals during courtship. In order to inflate them, a bird must first close its bill and block the internal nostrils with its tongue, to prevent air from escaping, while at the same time the glottis is placed at the entrance of the oesophagus, which can then be filled with the air that leaves the trachea. In addition to those already mentioned, other sounds that require the use of the

The Eurasian Black Grouse is one of six grouse species in which the males form leks or arenas. At these normally very sparsely vegetated sites, a varied number of males gathers to display, attract females and copulate with them. Shortly after arriving at the lek, the males make their characteristic "rookooing" call, cocking and spreading their tails to show off the white undertail-coverts to the maximum. Two males will often face up to each other and engage in bowing duels, a type of ritualized fighting which can sometimes lead to actual fights, particularly at the height of the display period.

[*Tetrao tetrix tetrix*,
Dalarna, Sweden.
Photo: Janos Jurka/
Bruce Coleman]



oesophagus are the "hooting" of the Blue Grouse, and the "cooing" of the Sharp-tailed Grouse.

Other common vocalizations, with different qualities of volume and range, made by male grouse include various grunts, hisses and cackles, as well as the high whistling song of the Hazel Grouse, which is quite similar to that of some Passeriformes. On occasions, a full range of different sounds can be heard together, such as the stereotyped song of the Western Capercaillie, with its four well defined phases appearing in a matter of barely ten seconds: first, a "tapping" reminiscent of water dripping or of sticks being knocked together; then a "drum roll" in which metallic notes accelerate until they almost merge together; next, a sudden "pop" like a bottle being uncorked; and, finally, a type of rhythmic rasping and unmusical panting, known as "whetting".

Non-vocal sounds can be produced by the wings, the tail, the feet or even by the bill, with different combinations depending on the species. Those produced by the wings are perhaps the most typical, and these are probably derived from displays in which the visual, not the acoustic, component was originally the most important, like the advertisement flights in *Lagopus* or the "flutter-flights" of other grouse (see Breeding). The speed with which the birds can beat their short wings along with the variable emargination of the remiges combine to produce diverse hissing, whirring or drumming sounds. Sometimes the wings even strike each other over the back, in the wing-clapping of the Spruce Grouse and the Siberian Grouse. Normally, these wing sounds are produced during short flights or jumps into the air, but often in the Hazel Grouse, and always in the Ruffed Grouse, when a bird is perched. In this last species, the well known "drumming" consists of the wings being beaten 50 times or so in only 5-8 seconds; they are beaten simply against the air, not against a log, as used to be thought. The procedure used by the Sage Grouse to produce "wing-rustling" is also peculiar: during display, a bird brushes its wings several times in quick succession against specialized, stiff feathers on the sides of the puffed out neck.

Characteristic sounds are produced by various species, upon opening and closing the tail abruptly, or on shaking it from side to side. In this way the Sharp-tailed Grouse produces "tail-rattling", the prairie-chickens "tail-clicking" and "snap-

ping", and the Spruce Grouse "swishing". Beating the ground rapidly with the feet, probably generating resonance inside the body, is known as "foot-stamping", and, though best known in the genus *Tympanuchus*, it is also present in a more modest version in the Spruce Grouse, the Willow Grouse and perhaps other members of Tetraonidae.

Some species can produce mechanical sounds in different ways. In the Spruce Grouse half a dozen are known: "clapping" and "drumming" with the wings; "stamping" with the feet; and "swishing" and "whooshing" with the tail. A mixture of vocal and non-vocal sounds is also quite usual, for example the Greater Prairie-chicken, along with "wing-shaking", "tail-clicking" and "foot-stamping", makes "whoop-calls", "cackle-calls" and "boomings". On the other hand, there is a certain amount of geographical variability at the subspecific level, which suggests that this could be a particularly flexible aspect of behaviour. Among other examples, "wing-clapping" is unique, within the Spruce Grouse, to the race *franklinii*, while Siberian capercaillies lack the "cork-pop" note in their song, and the frequency of "hooting" in the coastal races of the Blue Grouse is considerably higher than that of inland races.

As mentioned above, females normally have an even wider repertoire than males. Thus, while the vocalizations of male Blue Grouse are limited to only one song and two or three calls, the female has some eleven different calls. Interestingly, males and females of the monogamous genus *Lagopus* have an identical vocal range of up to 16 sounds in the case of the Willow Grouse, a similar number to those registered in Phasianidae for species such as the Chukar (*Alectoris chukar*) or the Ring-necked Pheasant. Some of the calls have a clear enough function, for example the "assembly call" that is used for gathering the chicks together, or "hawk alarm", which indicates the presence of a flying predator, but in some cases different authors have different interpretations. There is considerable scope for further investigation, and this could well lead to the discovery of new calls and new interpretations even in the better known species.

Vocalizations develop throughout an individual's life. Chicks have only a few, very specific calls, sometimes only two. One is for contact in normal situations, a "contact call", "contentment call" or "peeping". The other, a "lost call", "distress call" or "wailing", is used when a chick feels lost or



The male Sharp-tailed Grouse performs several courtship and territorial defence displays. The most complex is known as "tail-rattling" or "dancing". With the wings outspread and the neck feathers bristled up to expose the bare purple skin patch, the bird vibrates its raised tail producing a frictional rattling sound; at the same time, it moves forward with rapid series of steps, normally following a curving route. When two or more males coincide at a dancing ground, their "tail-rattling" displays are often highly synchronized.

[*Tympanuchus phasianellus*.
Photo: Scott Nielsen/
Bruce Coleman]

threatened. Both are immediately answered by the mother, either vocally or in some other way.

Food and Feeding

The diet of most grouse species is fairly well known. The fact that they are popular game birds has obviously been a significant factor in the motivation of many detailed studies that have been carried out. The specialized vegetarian diet of the group stands out, even more so than in the other Galliformes. Animal food is of minimal importance, except in the first few days, or at most the first weeks, of life.

In order to understand the feeding ecology of these birds, it is essential to consider their vegetarian diet within the framework of the extreme seasonal variation that dominates their habitats. During winter, the simplicity of northern ecosystems is especially marked, so that grouse are forced to adopt amazingly monotonous diets. For example, throughout most of their respective ranges for several months, capercaillies in Eurasia and Blue and Spruce Grouse in America eat practically nothing but pine needles or those of other conifers. Similarly, Ruffed Grouse specialize on aspens (*Populus*), Willow Grouse on willows (*Salix*), black grouse on birches (*Betula*) and Sage Grouse on sagebrush (*Artemisia*). These habits, of which hunters are naturally well aware, have influenced some of the vernacular names applied. In addition to the examples already mentioned of Spruce, Willow and Sage Grouse, there are Hazel Grouse, "Pine Grouse" for the Blue Grouse, "Cedar Partridge" for the Spruce Grouse, "Popple Partridge" for the Ruffed Grouse, "Heath Hen" for a race of the Greater Prairie-chicken, and many more. The presence or absence of the relevant plants can often affect the distribution of the different species (see Habitat).

Many of the most important plants in winter are conifers (*Pinus*, *Picea*, *Abies*, *Tsuga*, *Larix*, *Juniperus*), or members of a small group of interrelated families of primitive angiosperms, including Salicaceae (*Salix*, *Populus*), Betulaceae (*Betula*, *Alnus*) and Corylaceae (*Corylus*, *Carpinus*, *Ostrya*), all of which are fairly abundant in the cool temperate, northern eco-

systems. These are all trees or bushes, often the only plants that emerge above the layer of snow during the winter months. From these plants, the grouse consume mainly the buds of broad-leaved trees and the needles and buds of conifers. Towards the end of winter, the male catkins of deciduous trees usually become very important.

In spring, the melting of the snow normally allows access to ground vegetation, and with this the variety of the diet increases somewhat, although buds and catkins normally remain of prime importance for some considerable time. Some species eat early flowers, including buttercups (*Ranunculus*), anemones (*Anemone*) and primroses (*Primula*). However, the most radical change usually takes place well into spring or even in summer, when the undergrowth plants fruit. The tender leaves and berries of plants such as *Vaccinium* and *Empetrum*, or in mountainous regions *Rhododendron* or *Arctostaphylos*, normally form the bulk of the diet, along with lesser quantities of some Rosaceae, notably *Rubus*, *Ribes*, *Dryas*, *Fragaria*, *Prunus* and *Amelanchier*.

During the summer, most species also take insects and other arthropods, although normally only in very low proportions. In this aspect, the prairie-chickens constitute a notable exception, as both species eat many insects, above all grasshoppers, to the extent that the proportion of animal food can surpass 50% of the diet in the summer months; in the Lesser Prairie-chicken, a proportion of 40-50% insects has actually been calculated for the year as a whole. In any case, in all species the importance of arthropods seems to be considerable during the first stages of chick development, probably due to the high-quality proteins they contain. In the first days of life, chicks eat mainly ants and their larvae, grasshoppers, beetles and sometimes caterpillars and spiders. Nevertheless, they soon switch to a mainly vegetarian diet. One study of the Ruffed Grouse gave 70% insects in the first two weeks, as opposed to 30% in the third and fourth weeks. Similarly, Sage Grouse chicks were found to take 60% insects in the first week, with progressively smaller proportions in successive weeks, until only 5% were consumed in the twelfth week.

During autumn, the importance of berries in the diet can last for some time, although fairly early on, from about Sep-

The ground display of the male Western Capercaillie is both the most elaborate and the most characteristic form of territorial advertisement that this species performs. It normally takes place after the bird has called from a perch in a tree (tree display), and then descended to the ground with noisy flight (flight display). Once on the ground, having first adopted the "Thin-necked Upright" posture, it begins its characteristic song, which consists of four distinct phases. The neck and head are thrust upwards, thus causing the "beard" to stick out in front, while the tail is fully fanned and raised and the wings drooped somewhat, so that the conspicuous white shoulder patch is completely revealed. This display may be performed by one bird alone, or in the company of other males.

[*Tetrao urogallus*.

Photo: Felix Labhardt/
Bruce Coleman]





The strutting sequence of the male Sage Grouse, a lek-forming species, is one of the most spectacular displays performed by any grouse. It is performed with the long, pointed tail fully fanned and raised almost vertically. The movements and sounds of the display are highly stereotyped, and include a series of forward steps, rotating movements of the wings across the stiffened feathers on the sides of the breast and neck, producing a brushing sound, and inflation of the oesophagus, with associated expansion of two olive green skin patches on the foreneck.

[*Centrocercus urophasianus*, Colorado, USA.
Photo: Dieter & Mary Plage/Bruce Coleman]

tember or October, birds begin to consume pine needles and buds. This is perhaps in order to allow the slow development of the intestinal bacterial flora that must be prepared for when the first snow falls, when the austere winter diet is rapidly imposed. Even captive birds display this spontaneous autumn change in their feeding behaviour. For those forms that specialize on conifers, larches can be very important during the transitional stage, before they lose their leaves. Sometimes mushrooms too can be of some importance in autumn, for instance in the Ruffed and Spruce Grouse.

On the other hand, in contrast to the feeding preferences of most of the Phasianidae, seeds are of very limited importance to grouse. In the Ruffed Grouse, it has been seen that even the seeds ingested along with fruit pass through the digestive tract more or less intact and often manage to germinate in the excrements. Once again the prairie-chickens provide the exception, as they are mainly seed-eaters, especially during winter, when they often prefer to eat crop plants like sorghum or maize. This winter consumption of seeds, obviously impossible for the species that live in more northerly regions with more snow, is a fundamental adaptation of the prairie-chickens to life in grasslands, and in this habit they differ significantly from the Sage Grouse, which is tied to the leaves of sagebrush.

In spite of the fairly notable diet specialization of the grouse, occasional interesting geographical variations exist between the various different species. Sometimes these are due simply to the absence of the favourite plant or plants in a certain region. In the Cantabrian Mountains of northern Spain, where the present oceanic climate hampers the development of coniferous forests, the Western Capercaillie bases its winter survival on holly (*Ilex aquifolium*), whereas in the nearby Pyrenees it is able to stick to its habitual food source, pines. On occasions, their special diets seem to be affected by competition from similar species. For example, in areas like Alaska where the Willow Grouse and Rock Ptarmigan coincide, the former consumes mainly willow and the latter birch, but in Iceland, where it is alone, the Rock Ptarmigan hardly touches birch, other than when the snow covers the smaller willows.

As a vegetarian specialization is unusual amongst birds, there has been considerable attention regarding the nutritious value of the food taken by grouse. A recurring question that

has interested many workers is whether their winter food provides enough nutrition to allow them to remain in good condition, or simply to survive. It has been seen, for example, that the calorific value of the aspen buds that constitute the only winter food in many areas of the Ruffed Grouse is only about a fifth of that generated by normal fodder for domestic birds, and is not very different from the value obtained for the pine needles that other Tetraonidae consume. In some cases, it has been proved mathematically that it is indeed possible for the birds to satisfy their needs by processing relatively large quantities of such food, but apparently within fairly strict limits. In the Blue Grouse, captive birds remain in good condition if they consume around 170 g daily of Douglas fir needles, but they lose weight if they are given Engelmann spruce, the metabolizable energy of which, per gram of dry material, is approximately 64% of that of the fir. Could they not then simply make do with taking a larger quantity of spruce needles? The answer may be "no". The task of processing more than a quarter of a kilo of needles in a day could well be beyond the capacity of birds which on average weigh little more than a kilogram. There must be a limit somewhere to the prodigious adaptations of their digestive system (see Morphological Aspects)!

In accordance with this is the high degree of food selection recorded in many field observations. Grouse not only clearly prefer one species to another, but even show preference for certain parts of the trees, or they may prefer some particular trees to others. The Ruffed Grouse, for example, chooses the tallest branches of an aspen, where the buds are known to average larger and more nutritious. They also prefer older, gnarled, sick trees or those growing in unusual sites, in other words, trees subjected to some type of "stress" that causes them to produce more buds, the principle behind the pruning of fruit trees or rose bushes. It has long been known that in both the Western Capercaillie of Europe and the Spruce Grouse of America there are birds that spend almost all winter in a single pine tree, even though their browsing may leave the tree conspicuously damaged, while neighbouring trees may remain intact.

Also in accordance with a very low-energy diet, there are certain facets of the winter behaviour of the Tetraonidae that seem to save energy (see General Habits). The morphology of

Ritualized or actual fighting in defence of a territory is fairly common between males of the Greater Prairie-chicken. These confrontations, and also those in the other two members of the genus *Tympanuchus*, are characterized by short jumps into the air in which a bird attempts to strike its opponent with the bill and claws, and sometimes with the wings. A squatting posture with the tail cocked and a number of aggressive calls are also typical features of such combat.

[*Tympanuchus cupido*.
Photo: Annie Griffiths/
DRK]



these birds and in particular the thickness of their plumage allows their lower critical temperature, the minimum threshold of their thermoneutral range, to be about 0°C, as opposed to the 18°C that is normal in birds. In the Willow Grouse it can even be as low as -6°C. It seems that these low levels accompany metabolic rates at rest that, using the normal allometric equations, are quite a lot higher than in other birds for instance about 24% in the Blue Grouse and 31% in the Eurasian Black Grouse. But below these thresholds the metabolic expenditure necessary to maintain a constant internal temperature increases greatly, and with it the need for food. In the Eurasian Black Grouse, for example, it has been calculated that a bird weighing 1 kg requires 937 KJ a day at -5°C, as opposed to 1293 KJ at -25°C. Taking as an example a normal diet in the Alps, comprising 75% leaves of *Picea* and 25% leaves of *Vaccinium*, this means that at -5°C the bird needs to fill its crop, which can hold 120 g of food, four times a day, but at -25°C it needs to do so six times, or even seven if one allows for the greater metabolic expenditure implied by the increase in activity necessary for obtaining so much food. Naturally their digestive system is not capable of such a feat. For this reason, among other things, the refuges under the snow, where birds can remain for long stretches at rest without losing heat, are so important.

Another crucial moment in the calendar for grouse is spring, when breeding success could be affected if the food supply were somehow deficient. In these birds, the low capacity for storing fat reserves does not make it feasible for females to prepare in advance for egg formation, which, instead, they have to carry out as they go along. It depends on the conditions that they encounter each spring, for example how early or late the snow melts. Besides, the deficiencies can be in terms not only of energy, but also of nutrition. In the Scottish Red Grouse, for example, it has been established that both breeding success and population density are higher on those moors that are on alkaline soils. The reason seems to be that their staple food, the heather *Calluna vulgaris*, has a higher nutritional value on these soils than when it grows on acid ones, and has a higher content of proteins and perhaps also of potassium, phosphorus and other elements. Also, in spring females prefer to eat in artificially fertilized areas, and generally in those where the heather

has a higher nitrogen content, although this does not seem to be a particularly precise measure of the availability of protein. A selection is also made not only of the species of plant, but of plants of different ages or even of parts of plants, such as new buds, that are especially rich in nutrients; such selection has been proved for the Red Grouse, the Spruce Grouse, the Ruffed Grouse and other species.

Food quality can also vary from one year to the next, depending on the different resin content that certain plants are capable of producing, seemingly as a defence against browsing animals. In the Ruffed Grouse's favourite aspens, there are years when the flower buds contain so much resin that the birds clearly avoid them, perhaps because there are phenolic compounds in the resin that greatly inhibit the activity of the microbial intestinal flora. Some authors have even suggested that this could be the source of the fluctuations in numbers that many grouse species suffer (see Breeding), although this is an extremely complex matter that is still subject to considerable debate.

Breeding

One of the most significant and well known aspects of the biology of the Tetraonidae is the high frequency of polygynous mating systems. In these, males compete at sites known as "leks" or "arenas" to win the favours of the females, but they do not assist them at all in any of the breeding tasks. This conduct, besides being very spectacular, is comparatively rare in birds, with other notable examples in the Ruff (*Philomachus pugnax*), the Great Bustard (*Otis tarda*), the Kakapo (*Strigops habroptilus*), the Village Indigobird (*Vidua chalybeata*) and several manakins (Pipridae), cotingas (Cotingidae) and birds of paradise (Paradisaeidae), as well as a few other cases. But amongst the Tetraonidae there are several species that have probably arrived at the same solution independently. Of the 17 species in the family: six form typical leks, namely *Centrocercus*, *Tympanuchus* and the two black grouse; five species, namely the three *Lagopus* and Severtsov's and the Hazel Grouse, are essentially monogamous; and the other six, comprising *Falci pennis*, the Ruffed Grouse, the Blue Grouse and

the two capercaillies, can, to a certain extent, be considered intermediate.

The three species of *Lagopus* are typically monogamous, with males strongly territorial. The White-tailed Ptarmigan establishes territories in the spring, but the other two start as early on as autumn. As well as violent attacks, males manifest their presence using different visual and vocal signals. The Rock Ptarmigan, for example, combines both types of signals in the course of eye-catching advertisement flights. The birds first take off vertically until they are some metres off the ground, sometimes ten or more, then glide with the wings and tail wide open, at the same time making a rhythmical call that is audible up to a kilometre away; finally, they drop down again, still calling, to end up with a display posture. Territories are guarded with greater or lesser tenacity right through the winter until spring, when the females arrive after dissolving their winter flocks. Although there are frequent cases of polygyny, in general each male is paired with a single female, keeping her under surveillance until the end of the incubation period. In the Willow Grouse, an exception in the Tetraonidae, the male even accompanies and protects the offspring.

Hazel Grouse, also monogamous, establish territories and pairs in autumn before the leaves fall, the males using sharp territorial songs, more reminiscent of passerines than of gallinaceous birds; these are answered by the females with similar, though briefer, calls. The pair-bond can weaken during winter, but males remain faithful to their territories. Possession is reaffirmed, on the arrival of spring, by means of short flights between trees, or "flutter-jumps" in which the wings produce a very distinctive whirring sound that can be heard at a distance of 100 m. The famous territorial drumming of the Ruffed Grouse seems to have a similar origin, with males adopting a stiff posture on a fallen tree trunk or some other prominent site and beating their wings. However, while in the Hazel Grouse pairs remain together in spring, at least until incubation begins, male Ruffed Grouse are only concerned about their song posts and may copulate with more females if the opportunity arises; the females, for their part, make their nests without paying any attention at all to the territorial distribution of the males.

The Ruffed Grouse, then, uses a polygynous or, more precisely, promiscuous mating system, in which males maintain large territories and therefore are regularly scattered throughout the forest. The case of the Blue Grouse and the two species of *Falcipectnis* is very similar, with males, clearly polygamous, possessing very large territories within which they display and call. For example, the Blue Grouse has a "hooting" song of half a dozen low notes produced by means of expansions of the oesophagus, and birds will also jump as much as a metre up into the air with loud wingbeats, or "flutter-flights". Capercaillies use a peculiar intermediate system, by which males maintain sizeable territories, but for displaying tend to situate themselves near the points where several territories meet, so as to form a sort of loosely defined arena. These capercaillie display grounds are very variable in size, and also in the number of males in attendance; in Russia, for example, records range from 3-4 males in less than 10 ha, to 20-25 in 100 ha.

True leks have nothing to do with feeding grounds. They are places where year after year males gather together in order to perform their displays. They are typically sited in clearings in forest edge species, such as the black grouse and Sharp-tailed Grouse, and on hillocks with short grass and good visibility in grassland species. Each male maintains only a small display territory, sometimes the same one for several years in succession. The number of males that congregate is also variable, but there are often large numbers, with an average of 6-12 males and a maximum of 26 in the Eurasian Black Grouse, and an average of 8-9 males in the Greater Prairie-chicken, but up to 70 on occasions. In the Sage Grouse numbers vary locally, but in Wyoming there are 70 males on average, and no less than 300 have been cited together.

Males normally arrive at the arenas before dawn and remain there for a few hours each day. Each defends a small territory, the more central the territory, the smaller it is; it can comprise some 500 m² on average in the Greater Prairie-chicken, but, in

marked contrast, it can have a radius of scarcely a metre and a half in the Sage Grouse. More important than the size of the territory is its comparative location, as it is the centre of an arena that the females apparently tend to approach first. The displays in these species can be extraordinarily dramatic and complex. For example, a male prairie-chicken: lowers its head; inflates the combs over its eyes; raises its pinnae, the feathers on the sides of the neck; drops its wings until they touch the ground; lifts its tail and shakes it, or opens and closes it abruptly; drums the ground violently with its feet, in "foot-stamping"; runs alongside other males; puffs out its brightly coloured oesophagic air-sacs; and from time to time makes far-carrying, low intensity booming sounds. Moreover, when the females approach, it jumps into the air, calling and fluttering vigorously, or "flutter-jumping". Of course, there are all kinds of aggressive encounters, some of which are ritualized, but others that are so real that they can end up causing deaths. The jumps, dances and demonstration flights of the Eurasian Black Grouse, and the complex and fascinating "strutting displays" of the Sage Grouse provide equally attractive examples.

Much has been written regarding the possible evolution of these types of display, but they are still far from being well understood. Nevertheless, there are a few things that do seem to be clear. In the first place, there are no leks in cases where the breeding success, either of the male or of the female, clearly depends on the strict defence of a feeding territory. This territory can be crucial before laying, when the food supply is usually more limited, as it must permit the formation of the requisite number of eggs as early as possible (see Food and Feeding). In this situation, typical for example in *Lagopus*, competition between males is essential, and although some females prefer to associate with males that, although already mated, possess very good territories, monogamy is usually the rule. In polygamous species, on the other hand, females build their nests and look after their chicks, without concerning themselves about any form of border. Sometimes two or more nests can be very near one another, for example in the Western Capercaillie, with up to five active nests in little more than a square kilometre.

In second place, it also seems clear that when the female selects males and not territories, she does so basing herself on visual factors, notably the splendour and condition of their plumage, the vigour of their song and display, and finally their performance in direct confrontations in the arena, and the hierarchy that emerges. What is not clear, the "lek paradox", is the reproductive benefit for the female of selecting a good mate, if, in any case, she is not going to receive any help from him in raising the chicks. Be that as it may, sexual selection not only takes place through this behaviour, but is actually very strong; the low proportion of males per lek that manage to mate gives an idea of how strong it is. In the Greater Prairie-chicken, for example, it has been calculated that 71-89% of the copulation in any one arena is carried out by only one or two males, and in the Sage Grouse more than 90% of the copulations are performed by about 10% of the males, the so-called "master cocks". Given additionally the short average lifespan of these birds, it is not surprising that there is such notable dimorphism in size, colour and other secondary sexual characteristics among the polygynous species, whereas such differences are minimal in monogamous species. This exaggerated sexual selection may perhaps also explain the frequency with which abnormally aggressive males appear, like the famous "crazy cock" capercaillies, that without hesitation will attack people, horses, or vehicles that trespass through their leks.

The song or display activity of male grouse has its risks, especially because it can attract the attention of predators. For this reason, it usually takes place during the twilight periods, above all at dawn. Also, males normally select particularly safe places, for example in forest species like the Spruce Grouse or the Ruffed Grouse, areas of rather young forest where the high density of trees may prevent goshawks and other predators from gaining easy access to the site. Display also involves high expenditure of energy, above all among species like the Sage Grouse that form leks.

Territorial defence encounters between rival males of the Western Capercaillie normally begin with ritualized confrontations, both birds adopting a crouching posture and tilting the fully spread tail towards the opponent. At first the birds make powerful belch-like calls and bowing movements, and each pecks out at its opponent's head without actually making contact. If the confrontation continues, it may well turn into a real fight: the pecks intensify and begin to strike home; if one of the birds manages to lay hold of the other's "beard" or its neck, it will immediately attack it with very forceful beats of its wings. It is very unusual for a bird to be killed in the course of one of these combats, but there are various documented cases of males dying shortly afterwards of injuries received.

[*Tetrao urogallus*.
Photo: Eric Dragesco/
Ardea]



The date of commencing breeding activity in spring is usually quite variable in each species between different regions, depending on latitude and altitude, and from one year to the next, depending on how soon spring arrives. The Spruce Grouse, for example, begins to lay when roughly 50% of the ground is free of snow. Very probably this is connected with the females' need to have access to food on the ground before they become physiologically capable of forming eggs. On the other hand, laying is relatively synchronous within the same year between pairs in the same zone; for instance, 67% of the Spruce Grouse in one area may begin laying over a period of only 10 days.

The female selects the nest-site, a decision of major importance in terms of eventual breeding fitness. The nest is almost always situated on the ground, although the Western Capercaillie and the Hazel Grouse have been seen using old nests, some metres above ground level, that had been abandoned by other birds, for example birds of prey. Normally the nest is quite well hidden, partially covered by undergrowth in species of open areas, and close to tree trunks or large stones in forest species; at the same time, the incubating bird usually has reasonable visibility. The nest is invariably a shallow bowl, either in a natural depression or in one dug out by the female. Average maximum width varies from about 15 cm in the Hazel Grouse to 25 cm in the Western Capercaillie. The lining is usually rather basic, consisting of blades of grass, dry leaves or twigs that the female picks up whilst in the nest or from a very short radius round about. Often there are also feathers, which are probably deposited accidentally.

Average clutch size ranges from 6 eggs in the Spruce Grouse, the Blue Grouse and the White-tailed Ptarmigan to 12 eggs in the Greater and Lesser Prairie-chickens, with most species laying 8-10 eggs. Although it is difficult to generalize, larger clutches tend to correspond on the one hand to the smaller species, and on the other to the grassland species. A certain correlation with latitude has also been noted, but with the smallest clutches in the more northern species, the opposite of what normally happens in birds. Clutch size is, however, quite variable, both geographically and between years. For example, in

the Blue Grouse, the populations of Vancouver average 6.3 eggs, those of Washington 6.9 and those of Montana 7.5, while the range of averages for the Willow Grouse in Norway varied from 7.8 to 11.2 eggs between 1960 and 1969.

Average egg size ranges from 40 mm x 29 mm in the Hazel Grouse to 57 mm x 42 mm in the Western Capercaillie, with respective average weights of about 20 g and 50 g. As is logical, eggs are larger in the larger species. Nevertheless, in terms of relative proportions the situation is reversed, for instance each egg constitutes 4.5% of the females' body mass in the Hazel Grouse, but only 2.7% in the capercaillies, while the total weight of a typical clutch would be equal to 43% and 20% of the respective female body weights. The shape of the eggs lies somewhere between oval and short subelliptical, and the shell is smooth. The colour is variable, but normally with a creamy buff or yellowish background that is slightly more reddish in *Lagopus* and greenish in the prairie-chickens and the Sage Grouse, probably because of their particular habitats; there are brown or blackish markings, relatively few in most species, but abundant in *Lagopus*.

Incubation does not normally start until the last egg has been laid, and in all species it is undertaken by the female alone. It lasts from 21 days in *Lagopus* to 26 days in the Sage Grouse, averaging longer in the larger species. During this time, females rarely leave the nest more than two or three times a day, preferring to do so early in the morning and late in the evening, for short periods of around twenty minutes or half an hour each time, just enough time to eat. They also take the opportunity to leave their droppings some distance from the nest; these droppings are different from normal ones, as a result of the accumulation of the intestinal faeces that are normally expelled continuously (see General Habits). These droppings, known as "clocker droppings", are easily recognized by their length, their somewhat spiral form and the higher proportion of uric acid.

The incubating female's almost perfect immobility is essential in order to make the most of her cryptic coloration. In this she trusts blindly, so much so that sometimes an incubating bird will allow itself to be touched. Nevertheless, animals such as foxes, badgers, wild boars, squirrels or different corvids

often find the nests, and predation is, in fact, responsible for the vast majority of losses that occur. According to the extensive literature available, some or all of the eggs usually manage to hatch at around 60-70% of all nests. The genus *Lagopus* is exceptional in generally having a success rate of over 80%, while the grassland species hardly reach 40-50%.

In cases of complete clutch loss, females can in principle, after a couple of weeks, lay a replacement clutch, normally smaller than the initial one, in another nest. However, this seems to be comparatively rare in most species, although it may simply be due to the scarcity of information available. The prairie-chickens are the exception, perhaps as an adaptation to the high losses that they suffer like many grassland birds. A study of the Greater Prairie-chicken showed that, of 14 females equipped with transmitters, three nested again after losing the first clutch, one of them twice; and another study has even shown that third attempts are actually common in the Sharp-tailed Grouse.

Hatching is almost simultaneous at any particular nest, due mainly to the communication that is established through individual chicks cheeping at different rhythms which indicate that they are closer to, or further from, hatching. From the beginning of the pipping of the first egg until the last chick hatches takes barely a day, or at most two. Very shortly afterwards, as soon as all the chicks have dried out, they abandon the nest following the female. Like other galliform chicks, they are extremely precocial. The digestive tract and the legs develop particularly quickly, so that the chicks can immediately eat on their own, without the female having to show them what to eat or how to eat it, and they may travel several hundred metres per day. Their wings also develop extremely early: at hatching, most, if not all, of the primaries can already be seen in active growth, as can some secondaries and the greater upperwing-coverts. In very few days, perhaps only 4-5 in the Hazel Grouse, they are capable of raising themselves several centimetres off the ground, and in about 10 days they can fly up several metres. These precocial flights offer them some security against predators, and, for instance, from an early stage they can already spend the night in branches some way off the ground.

Again as in many other Galliformes, females look after their chicks extraordinarily well. Besides leading them to areas that are rich in the food they need, basically insects during the first few days, they defend them fearlessly, often attacking even humans. They also resort to distraction displays, such as feigning injury. The alarm calls of the mother cause the brood to disperse, each chick running in a different direction to hide and remain still until the danger passes. But perhaps most importantly, the female protects the chicks from the adversities of the climate. In the habitats occupied by grouse, sudden cold, rain and sometimes snow can appear unexpectedly very late in the season, and, as the chicks are not capable of efficient thermoregulation for quite some time, it is essential for the mother to warm them by covering them with her wings. It is claimed that, after five minutes of walking alone in a fairly moderate temperature of 12°C, small capercaillie chicks start to search for some source of heat, and if they do not find it, they die within three quarters of an hour. As soon as the chicks are able to do without brooding, it becomes rare: in the Blue Grouse, almost 90% of the observations of females brooding chicks take place in the first week after hatching. Nevertheless, chick mortality due to inclement weather is almost always high in the Tetraonidae.

The growth of the chicks is relatively rapid. Long before they have reached adult size and weight, they go through their first moult, beginning with the innermost primary, which is shed at two weeks in the Ruffed Grouse and at four in the Greater Prairie-chicken. Little by little the chicks wander farther from their mother when foraging, and towards the end of summer or the beginning of autumn, when they are about three months old, the family bonds are finally broken and each chick goes off on its own. By this time predators or bad weather have reduced the size of the brood significantly. In one study of the Western Capercaillie in Germany, for example, of 8-9 chicks leaving the nest on average, only 3-4 survived after a couple of months. In another study of the Sage Grouse in Colorado,

families contained an average of 5-6 chicks in June, but only 2-3 by August. Comparable figures are available for other species, although logically they are lower on average in those that lay fewer eggs initially, like the Blue Grouse, than in those that lay more, above all *Tympanuchus*. In fact, the Greater Prairie-chicken can have an average of 6-6 chicks per family well into the summer. Very often there are significant variations from one year to the next within the same species and the same region. For instance, in Scotland in the period 1945-1963, the Rock Ptarmigan raised average broods of 1-2 to 6-2 chicks.

By linking hatching success with average brood size, it is possible to make rough estimates regarding the levels of recruitment that probably operate in grouse populations. Another factor to remember is that grouse reach sexual maturity in their first year, although males of polygynous species, especially those that compete at leks, do not manage to copulate until at least their second year. All things considered, annual recruitment is fairly high in comparison to that of other birds. A logical deduction from this, however, is that the average lifespan of grouse should be very short. Indeed, annual adult survival rates that have been calculated for different species are usually between a maximum of 60-65% for the Blue Grouse and the Western Capercaillie, and around 30% in the Hazel and Willow Grouse. These figures give respective average lifespans of two years or a little more in the first case, and barely 10 months in the second, in both cases starting from the first autumn. Thus a generalization for a medium-sized member of Tetraonidae would give adult mortality of about 50%, with the corresponding further year and a half of life for those young birds that succeed in surviving the summer.

As is to be expected, clutch size corresponds closely to the typical mortality rate of each species, so that larger species generally live longer than smaller ones, and forest species live longer than those of open country. An interesting case is that of the White-tailed Ptarmigan, which differs notably from its congeners with their relatively small clutches of 5-6 eggs on average, and their high life expectancy of about three years. This could perhaps be due to the relatively low density of predators in the high mountains in comparison with the Arctic tundra, where there are many animals that habitually prey on the other *Lagopus* species, notably the Arctic fox (*Alopex lagopus*), the stoat (*Mustela erminea*), the Gyrfalcon (*Falco rusticolus*) and the Snowy Owl (*Nyctea scandiaca*). As is to be expected for primary consumers, grouse are not by any means short of enemies, and predation is the main cause of mortality; few grouse can meet a peaceful end! A wide diversity of carnivorous mammals (*Martes*, *Lynx*, *Vulpes*, *Urocyon*, *Canis*), raptors (*Accipiter*, *Buteo*, *Aquila*, *Falco*) and owls (*Strix*, *Bubo*) can be considered important predators, as shown by several studies. The Northern Goshawk seems to be a true specialist predator of forest grouse, accounting for 74% of the recorded captures of Blue Grouse in a study in British Columbia; it is also the most important predator of the Hazel Grouse in Eurasia, and of the Ruffed Grouse in America. A single nesting pair of goshawks has been calculated to kill up to 40 Hazel Grouse a year in the Polish forest of Bialowieza, and up to about 300 Ruffed Grouse on Cloquet Island, Minnesota (USA). Logically, due to the differences in leaf duration, those species that spend the winter in conifer forests are better protected than those that winter in deciduous ones, which helps to explain why mortality is lower in the Spruce and Blue Grouse and the capercaillies.

Of course, in addition to predators, disease and parasites also take their toll. In the Red Grouse, for example, the intestinal nematode *Trychostrongylus tenuis* has been identified as an important cause of mortality, especially of chicks. Given that the incidence of this parasitic worm is more pronounced when population densities are at their highest, it has even been imputed as the cause of population cycles. Up to 20 different species of nematode are known to infect the Ruffed Grouse. The performance of males at the lek can be affected by a serious infestation, and recently this has even been proposed as a possible explanation for the "lek paradox". What the females obtain upon selecting males with better developed secondary

The nest of the Ruffed Grouse is a bowl formed in leaves on the forest floor. It is often protected, at least on one side, by boulders or by some other upright object, such as a stump, a log or the base of a tree. Nevertheless, whilst the female is incubating, her best protection against predators is the cryptic coloration and pattern of her plumage. Hen grouse are so confident in their ability to pass unseen on the nest that it is sometimes possible actually to touch an incubating bird before she decides to leave the nest.

[*Bonasa umbellus*.
Photo: Leonard Lee Rue/
FLPA]



sexual features, such as plumage in excellent condition, cervical sacs without haematomas due to lice, a high frequency of strutting, and so on, would be those genes resistant to parasites for their immediate descendants. A larger number would survive and this would obviously increase the individual fitness of the female that has made the appropriate selection.

A characteristic of animals, like the Tetraonidae, that have high birth and death rates, is that their population levels are usually very unstable, and this certainly is the case of the grouse. For example, extreme densities of 0.5-2.9 birds/10 hectares have been registered for the Spruce Grouse in Alberta (Canada) over a period of 21 years, in other words almost six times as many birds some years as in others. Similar or even greater variations have been recorded for the Willow Grouse and the Rock Ptarmigan in different regions. However, the most interesting feature is that these population changes usually follow more or less regular cycles that can sometimes be detected with only an elementary analysis of the hunting statistics. A cycle of roughly ten years for the Ruffed Grouse in North America and other boreal animals, such as the Canadian lynx (*Lynx canadensis*) and the snowshoe hare (*Lepus americanus*), has been well known for many years. Cycles of ten years have also been noted in the Rock Ptarmigan in Alaska and Greenland, but in the same species in Iceland cycles are of 3-4 years. Similarly, the Red Grouse has cycles of six years in Scotland, and of 3-4 years in Fennoscandia and northern Russia. Similar cycles have been documented for the Western and Black-billed Capercaillies, the Eurasian Black Grouse and the Hazel Grouse.

The phenomenon has intrigued animal ecologists, and many theories have been advanced to explain it. Two kinds of possible population regulating factors have been postulated, extrinsic and intrinsic. Within the first are changes in predator density, the incidence of parasites and disease, food quality or climate, but none of these factors has offered a convincing explanation, particularly considering the surprising regularity of the cycles. The intrinsic alternatives are connected with the typical behaviour of individuals. Basically, during periods of high population density male territoriality is intensified, so that in autumn males defend larger areas, expelling the weaker or less aggressive individuals, causing higher mortality of such birds during the winter. This has a genetic implication, since in these periods the more aggressive phenotypes with a higher possibility of survival would be selected. Gradually the accu-

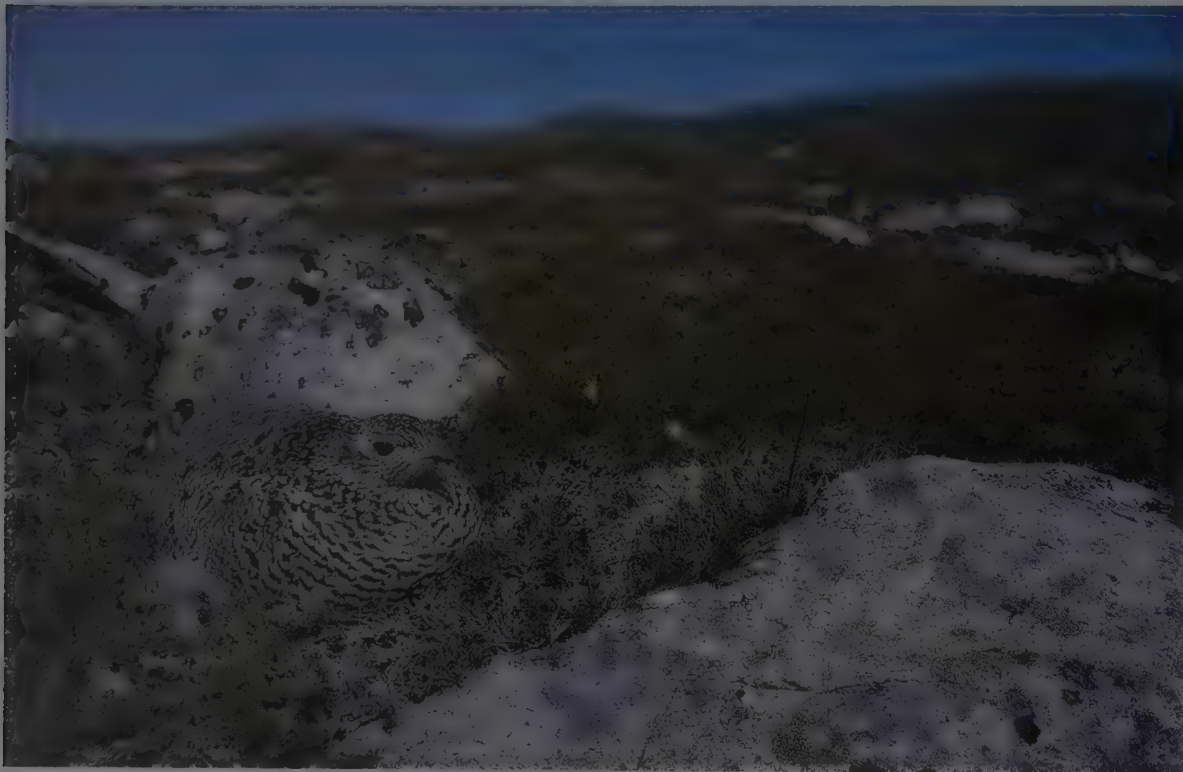
mulation of aggressive phenotypes in the population would cause average territory size to grow, and at the same time the number of individuals to decrease. Inversely, periods of low density would catalyse the selection of tolerant phenotypes, perhaps because very aggressive males consume too much energy in defending their extensive territories or are more exposed to predation, and in the long run this different type of selection would allow the demographic levels to rise again.

In spite of the definite appeal of this proposal, made originally by D. Chitty in 1967, and applicable to other vertebrates with fluctuating populations, such as voles or lemmings, many authors feel that this is still far from being a fully satisfactory explanation. At present this hypothesis is the subject of considerable experimental research, which may soon offer convincing proof. It has already been seen, for example, that chicks in captivity corresponding to different population levels show very clear differences in the frequency and intensity of their antagonistic behaviour, and that these differences are inheritable.

Movements

Grouse tend not to be very mobile, either in their daily routine or throughout the year. This is only to be expected from their morphology, which is not well adapted to sustained flight, or from their ecology, which is based on a relatively easily obtained vegetarian diet. They do not migrate in the strict sense. In some species, certain populations move within a range of dozens, or at most hundreds of kilometres, but these movements generally lack clear direction or precise timing, and are often determined by local weather conditions or food availability. Their movements can thus be better described as nomadic or even erratic.

The forest species are usually the least mobile, probably because their winter food always remains above the snow. However, definite food preferences lead to some local displacements. Most of the Western Capercaillies that nest in broad-leaved forests in the southern Urals spend the winter in pine forests fairly far away, while in the Blue Grouse a reverse altitudinal movement occurs, birds tending to winter in conifer forests high up the mountains. The genera *Falcipectnis*, *Dendragapus*, *Tetrao* and especially *Bonasa* are strongly sedentary. In the Hazel Grouse, for example, a study of ringed birds in Russia showed



During the breeding season, the Rock Ptarmigan prefers areas with more or less continuous heather, broken by outcrops or large boulders. The nest is simply a shallow depression produced by the female's weight and movements, although the bottom may be lined with some feathers or leaves. It is normally situated beside a bush or a large rock which gives the female some extra cover during the 21-24 days of incubation. Nonetheless, as in other grouse species, the female relies mainly on her remarkably cryptic plumage to escape the attentions of predators.

[*Lagopus muta millaisi*, Cairngorm National Nature Reserve, Scotland. Photo: Benoît Renevey]

that more than half the birds recovered were found within a radius of 200 m from the point of ringing, with 88% of them less than 500 m away, while the farthest was only 1500 m away.

At the opposite extreme are the genus *Lagopus* and the Sage Grouse, which may perhaps be qualified as partial migrants. In the Sage Grouse, a fair number of high altitude breeding areas are completely abandoned during winter, in favour of quite distant valleys, sometimes up to 100 or 150 km away. In the Willow Grouse, and to a lesser extent in the Rock Ptarmigan, different populations carry out altitudinal movements over short distances. Some populations of the Arctic tundra, in Siberia or Canada, regularly move towards forested regions quite some way farther south. Thus, it is calculated that roughly 50,000 Willow Grouse pass every autumn through the Anaktuvuk Pass, in the Brooks Range of northern Alaska. Those that nest on the Russian islands of Kolguev and New Siberia move to the mainland, covering distances of 80 km and 120 km respectively, although perhaps only when the straits have enough ice on which they can rest if need be. Some years there are mass movements, for example of the Rock Ptarmigan in Greenland; as with other Arctic species, like lemmings, such movements could be related to exceptionally high population levels. On such occasions the Greenland ptarmigans suddenly erupt in large flocks in the south of the island, after having travelled hundreds of kilometres, and it is believed that some may even continue further, as some birds have been found in Iceland with non-volcanic grit in their gizzards. It is clear that occasional irruptive movements may also occur in forest species, and, for example, in the autumns of 1943 and 1944 in Sweden long range movements of Western Capercaillies and Eurasian Black Grouse were registered, with some birds recovered at more than a thousand kilometres away. Movements like this may also occur fairly frequently in Siberia.

Nevertheless, there are two apparently more or less fixed rules in this family, as in so many other bird families. One is the autumn dispersal of juveniles, and the other that males tend to be more tied to their habitual areas than females, so that, if they do actually leave, they move shorter distances on average and for shorter periods. Therefore, in ringing studies there is often a very clear split between the sexes and also different age categories. For example, in the White-tailed Ptarmigan in Colorado, while adult males make average movements of only 2.5

km and subadult males of 4.0 km, the corresponding figures for adult and subadult females are 6.8 km and 8.5 km.

Relationship with Man

Man's main interest in the Tetraonidae over the years stems from hunting, and it is naturally much more highly developed than any other relationship between the two. Prolific and common over extensive areas, of good size and flavour, they have always been prized as a good source of protein by diverse northern cultures, and they are perhaps only surpassed by the Anatidae in this respect. Grouse bones are regularly found in European Paleolithic middens, showing that the climate was actually colder then than at present. The flesh of these birds is still important for many peoples of the North, from the Lapps to the Eskimos. Curiously, man has not domesticated any species, although there are several that can be kept and raised perfectly well in captivity.

The statistics available for the hunting of grouse at a global level are rather incomplete. For the American species, P. A. Johnsgard calculated that at the end of the 1970's almost 8,500,000 Tetraonidae were killed annually, 5,000,000 of them in the USA. The most intensively hunted species, with some 6,000,000 birds killed per year, was the Ruffed Grouse, followed at considerable distance by the Sharp-tailed Grouse with 700,000, the Spruce Grouse with 550,000, the Blue Grouse with 520,000, the genus *Lagopus* with 300,000, and the Sage Grouse with 270,000. The figures corresponding to the now rare prairie-chickens were a good deal lower, with 61,000 Greater and 6700 Lesser Prairie-chickens killed.

In the same way that the Ruffed Grouse is an extremely popular game bird in North America, so is its relative the Hazel Grouse in Russia, especially in Siberia, although it is less so in Western Europe. In the Old World, the most hunted species is the Willow Grouse, especially in the former Soviet Union, where annual captures have been calculated in the order of about 8,000,000 birds. The same species is also intensively hunted in the British Isles, where the local race is the Red Grouse. The number of birds shot some years in Scotland and northern England is quite remarkable, with up to about 2,500,000 birds in 1911. But since the 1940's there has been a

gradual decline in numbers, which were down to under 500,000 pairs around 1976, and, in spite of a comparative recovery recently, still no more than 400,000 birds a year are being shot. Given the economic importance of shooting, it is not surprising that a great deal of research has been carried out, and this has certainly resulted in the species' biology being much better known. It now seems that the decline in numbers is not due to excessive hunting but rather to inadequate management of the habitat, perhaps because fewer gamekeepers and shepherds are now employed. Some areas are overgrazed, while in others the heather is allowed to grow large and old, whereas before it underwent careful rotational burning in order to guarantee both enough ground cover and the continuous provision of nutritious stalks, with the result that now it can not offer the same sustenance to the grouse. Additional factors are the exponential increase of predators, with an estimated thirtyfold increase in the number of foxes between 1920 and 1970, and in some areas the fragmentation of suitable habitat, so that the species is progressively reduced to pockets of such habitat, where, in the case of extinction, recolonization becomes increasingly unlikely. Even so, in Britain there are still around 1,000,000 ha in which hunting of the Red Grouse contributes to the maintenance of the moors with their characteristic flora and fauna; many of these moors might otherwise be destined to other uses that are far from attractive from the point of view of conservation, such as conifer plantations.

In the rest of Western Europe, grouse are generally so scarce nowadays that they have little importance as gamebirds, except in Finland, Scandinavia and the Alpine countries. The Western Capercaillie is already strictly protected almost throughout Central Europe, for example since 1970 in Germany. The Eurasian Black Grouse is hunted only in limited numbers, around 1500 males a year in the cases of Austria, Switzerland and Poland, while the number of Hazel Grouse taken tends to be even smaller. On the other hand, up to end of the 1970's in Norway and Sweden taken together, some 40,000 Black Grouse, 30,000 Western Capercaillies and 30,000 Hazel Grouse were still shot. In Finland, annual figures

throughout the 1960's and 1970's were even higher, with 54,500-171,500 Eurasian Black Grouse, 14,500-33,000 Western Capercaillie and 28,200-69,600 Hazel Grouse. In these nordic countries, quite a number of Willow Grouse and Rock Ptarmigans are also hunted, especially in Norway, where the annual average for the period 1975-1980 was 423,000 birds killed.

Nevertheless, the figures often do not reflect the full economic and social importance of grouse hunting. Some species are considered highly desirable trophies, mainly due to their size and striking appearance. Of some interest are the peculiar hunting practices used for species with courtship displays. The Western Capercaillie and the Eurasian Black Grouse have been hunted traditionally in spring in Central Europe, although it is only males that may be taken. In the case of the former, hunters have to approach the displaying males stealthily before dawn, taking advantage of moments of deafness that the birds seem to experience during certain phases of their song.

Status and Conservation

Although nowadays only one species in this family is considered globally threatened, there are quite a few that have shown special sensitivity to alterations of their habitat due to man. In particular, marked decreases in numbers and considerable reductions in range have taken place on two main fronts, the forests of Europe and the grasslands of North America. But the typically huge ranges of the Tetraonidae, extending far into cold and sparsely populated regions of Siberia and Canada, mean that the various different species can generally be considered relatively secure.

The exceptions may be the three species with restricted ranges, the Caucasian Black Grouse, the Siberian Grouse and Severtsov's Grouse. The first of these is the only species in the family that is currently considered to be globally threatened. It is classified as Insufficiently Known, which reflects a rather generalized uncertainty about its status. In Azerbaijan, it is

The eggs of the Eurasian Black Grouse are creamy white in background colour, with profuse brown speckles. In this species, clutch size ranges from six to eleven eggs, apparently with a higher average number of eggs in areas where the population density is higher. The nest is a scrape in the ground lined with plant material and feathers, and is normally well hidden amongst shrubs or tall vegetation. During the four-week incubation period the female normally leaves the nest to feed three times a day, in the morning, the early afternoon and the evening.

[*Tetrao tetrix*.
Photo: John Hawkins/
FLPA]





As a consequence of the cold climates inhabited by grouse, and the chicks' insufficient capacity for thermoregulation in their first days of life, brooding is one of the most important functions performed by the female towards the survival of her chicks. While they are young, it is very common for the female to keep them warm by covering them with her wings, as illustrated by this Willow Grouse. This is particularly important during cold spells, rain or even snow, which can arrive quite unexpectedly at any time of year in many parts of the family's range.

[*Lagopus lagopus*.
Photo: Stephen
Krasemann/
NHPA]

uncommon, with perhaps some 1500-2000 individuals; here, outside protected areas it has decreased as a result of intensive grazing of subalpine meadows, and also a certain amount of predation of young by sheepdogs. However, it may still be reasonably common elsewhere. The Siberian Grouse is a rare bird everywhere, and it tends to disappear quickly from the areas of the taiga settled by man, perhaps because its particularly unwary behaviour makes it excessively vulnerable to hunting; in some places it can apparently be captured with long, hooked poles. There is virtually no information available on the population sizes and trends of Severtsov's Grouse, and its numbers could be very small.

At the subspecies level there are more forms that cause concern, especially in the genus *Lagopus*, with quite a few isolated populations, often with limited numbers in southern areas. Some are suffering from problems caused by human recreational activities, such as ski-ing, and also from too intensive hunting pressure. On top of this are possible difficulties arising from climatic variations, impoverished food supplies and other limitations. Nevertheless, at the species level, because of the remote, unproductive areas they occupy, there is no doubt that these three forms have a fairly optimistic perspective for the future.

Although most species are subjected to exploitation as gamebirds (see Relationship with Man), it seems that this has rarely had an excessively negative impact as regards the conservation of the species. The high birth and death rates of these birds mean that hunting yields are normally well below the sustainable maximum. Much of the mortality caused by a limited degree of hunting should be offset by the increased possibility of survival for each individual that is not killed. This is especially true over the winter, as there will be reduced competition for resources, and maybe also a decrease in the incidence of predation, parasites and other mortality factors that are density dependent. To what point this compensation is partial or even total is still not very clear, but, for example, it is known that a harvest rate of 30% in the Red Grouse can be sustained with no drop in numbers at all. On the other hand, the same high demographic rates allow rapid recoveries in protected areas, or during specially extended close seasons. In principle, introductions or reintroductions also tend to give

good results, due in part to the fact that grouse, like most Galliformes, breed well in captivity.

On the whole, the American grassland species are those that have suffered most from the actions of man. The arrival of agriculture had a major impact on the prairie-chickens, and a lesser one on the Sharp-tailed Grouse, which is more a species of the ecotone. The story of the nominate race of the Greater Prairie-chicken, the "Heath Hen" of the east coast colonists, is well known. Originally, it seems that it was commonly found from Massachusetts to Maryland. One of the first laws to protect any bird species in America was decreed in New York, as early as 1791, establishing a spring ban on the massive captures of this species that took place on Long Island, for sale in markets. But around 1844 the species disappeared from the state of New York, and by about 1869 it had gone from the rest of its range except the island of Martha's Vineyard in southern Massachusetts. There, protected by law from 1824, the species underwent considerable population cycles, for example with only 60 birds in 1908, as opposed to 2000 in 1916. In spite of all the efforts made, the last representative, a ringed male, which was apparently the lone survivor during almost five of its eight years of life, was seen for last time in March 1932. Another race, *attwateri* or Attwater's Prairie-chicken, restricted to the coast of Texas, was classified as Rare in the 1978/1979 Red Data Book. At present, its total population is down to under 1000 birds, a far cry from the 1,000,000 that are reckoned to have occurred during the last century. The transformation of the habitat into agricultural land, mainly rice fields, seems to have been the main cause of this decline.

The most widespread race of the species, *pinnatus*, actually benefited at first with the arrival of agriculture in the prairies, due to the importance of grain as a winter food source. In spite of the large-scale hunting it was subjected to, around the end of last century not only did it reach maximum populations in many areas, but it also spread fairly rapidly to states to the west and north, as well as to the prairie provinces of Canada, where it reached the level of Edmonton, Alberta, in 1900. Later, however, the increasing intensification of agriculture reversed the trend, as the virgin stretches of prairie that the bird required for breeding habitat disappeared. Virtually eradicated from Canada, it is now thought to be rare or regionally extinct in the

states of Michigan, Ohio, Kentucky, Indiana, Illinois and Iowa, and in the south, in Arkansas and Texas, in other words most of its original range in what was the Tall-grass Prairie. Curiously, it is in the western states of Short-grass Prairie, like Kansas and Nebraska, where the species was more marginal, that the healthiest populations are now to be found. This is undoubtedly because of the pastoral, rather than agricultural, use of the land, whereas in Missouri, for example, it is believed that no more than 0.5% of the original prairie remains.

The status of the Lesser Prairie-chicken is reckoned to be stable. However, its total population may number only some 50,000 birds, while it has a rather limited range of about 25,000 km² in only four states, less than 10% of its original range, so there is cause for concern. The prairie-chickens have been, and probably still are, the main "flagship species" in the fight for the conservation of what remains of the prairies. They have, for example, been the motivation behind the creation of numerous reserves, which, if these are large enough to cater for the needs of these species, are also sufficient for all the other prairie birds. By 1964, within the National Grassland System, the Federal Government of the USA already had 19 nature reserves in 11 different states, covering a total of 1,600,000 ha, while there were many other reserves both publicly owned and belonging to private conservation organizations. Other conservation measures already under way, with better or worse results, include: provision of extra food; elimination of introduced pheasants; predator control; reintroduction, or bolstering of populations; and, most importantly, habitat management and improvement, through the regulation of grazing by sheep, and also periodical controlled burning. Such burning is essential, as the invasion of the grasslands by shrubby vegetation, either autochthonous or introduced, is a threat that could become particularly serious in the long term.

Up to now, the Sage Grouse has been slightly more secure in its habitat in the arid western plains. But agriculture is being steadily intensified in this area, supported by modern irrigation techniques which combine very deep wells and centre-pivot systems. In addition, the sagebrush that is so important to the species is increasingly being eliminated, either mechanically or by herbicide spraying, with a view to improving the land for cattle ranching. Indeed, by 1967 some 12,000-15,000 km² of sagebrush had already been removed, while by 1975 the original expanse of sagebrush in Montana had been reduced to a mere 10%.

In the case of the forest species, moderate levels of logging generally have a beneficial effect on populations, as often does fire, at least temporarily, revitalizing the forest by allowing the growth of patches of broad-leaved trees, such as birches or aspens, or leaving glades open for colonization by berry-bearing shrubs, such as *Vaccinium*, and therefore increasing the food

supply. Because of this colonization by man of the boreal forest zone, different grouse species have been able to increase their density and range temporarily. For example, the numbers of Eurasian Black Grouse are said to have increased in many parts of Europe during the last century, and they are apparently still increasing in much of Siberia. However, intensive exploitation of forests ends up eliminating marginal areas, for example the planting of pines on heather moors or in birch forests, while it also converts the forests into monotonous expanses of trees all of the same age. In such circumstances, the habitat is substantially altered, especially as regards food potential, and the grouse populations very quickly go into decline. The Eurasian Black Grouse has now been converted into an authentic rarity in Central Europe, eliminated not only from the plains but also from mountains such as the Vosges, the Jura and the Sudety, and recent trends in Scandinavia and Finland are little better.

Perhaps the situation is even worse for the Western Capercaillie, a more distinct forest specialist. It was formerly found throughout the cold and temperate forests of Europe, but now, except in Fenno-Scandia and Russia, it is only found in mountains at fairly high altitude, for example in the Alps normally only above 1200 m. In the past, the main reason for the decimation of populations of this magnificent species was forest destruction carried out in order to make way for agriculture and livestock. The later policies for forest development, along with special game protection measures achieved notable recoveries in many areas. For example, in the British Isles the species was eradicated towards the end of the seventeenth century, but it was successfully reintroduced in about 1837-1838, and for some time underwent considerable increases. But now, from Scotland to Finland and from the Cantabrian Mountains to the Carpathians, populations are everywhere in decline, and again forestry, now in its modern industrial style, seems to be the culprit. In Scotland, for example, average winter densities have been recorded three times higher in natural forests than in plantations. Similarly, it has been seen in Scandinavia that modern forestry techniques struggle to satisfy the ecological requirements of the species, both in the breeding season and in winter. The future of the species in Western Europe seems even less certain if other aggravating factors are considered, such as the genetic isolation of the small residual populations, poaching, problems caused by ski-ing and tourism in general, the creation of new paths and roads, pollution in the form of acid rain, and the ensuing destruction of forests, and in southern areas, perhaps, long-term climatic changes.

General Bibliography

- Aldrich (1963), Andreev (1980, 1988a), Aschenbrenner (1982), Baines & Lindén (1991), Bateson (1983), Bendell (1972), Bergerud (1985, 1988b, 1988c, 1988d), Bergerud & Gratson (1988a, 1988b), Bergerud *et al.* (1985), Braun & Willers (1967), Brodtkorb (1964), Bryant & Kuropat (1980), Chitty (1967), Ellison (1991), Gibson & Bradbury (1985), Glutz von Blotzheim *et al.* (1985), Gray (1958), Hamerstrom & Hamerstrom (1960), Hannon (1989), Hjorth (1970, 1976), Höglund, J. (1989), Höglund, N.H. (1964c), Höhn (1977), Holman (1964), Hudson & Lovel (1984), Janossy (1976), Johnsgard (1982, 1983a, 1985), Johnson & Lockner (1968), Jönsson *et al.* (1991), Keith (1963), Kirikov (1975), Klaus (1991), Krebs (1978), Lack (1964), Leopold (1953), Lindén (1989b), Lindén & Rajala (1981), Lovel (1979, 1982), Lovel & Hudson (1985, 1988), Marcstrom (1988), Marcstrom *et al.* (1988), Marjakangas (1980), Marjakangas & Moss (1991), McEwen *et al.* (1969), McGowan (1975b), Morioka (1975), Moss (1983), Moss & Hansen (1980), Moss & Watson (1991a), Moss *et al.* (1974), Myrberger (1985), Oakes (1992), Page & Bergerud (1988), Peterle (1951), Peters (1934), Porkert (1969b, 1972, 1975a, 1975b, 1976, 1979, 1983, 1991a, 1991b), Potapov (1969, 1970, 1972, 1976, 1982a, 1985, 1992a), Raethel (1988), Remington (1989), Robel (1972), Rutgers & Norris (1970), Salomonsen (1972), Semenov-Tjan-Shanskij (1960), Short (1967, 1969), Sibley (1957), Sibley & Ahlquist (1990), Sibley & Monroe (1990), Sibley *et al.* (1988), Siivonen (1957), Stock & Bunch (1982), Stokkan (1992), Stresemann (1966), Sych & Bogdanovich (1988), Thomas (1987), Veghte & Herreid (1965), Verheyen (1956), Volkov (1968), de Vos (1979), Watson & Moss (1979), Wiley (1974), Wittenberger (1978).

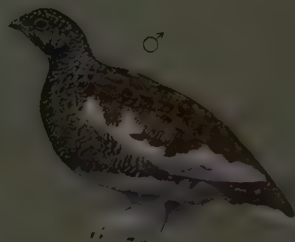
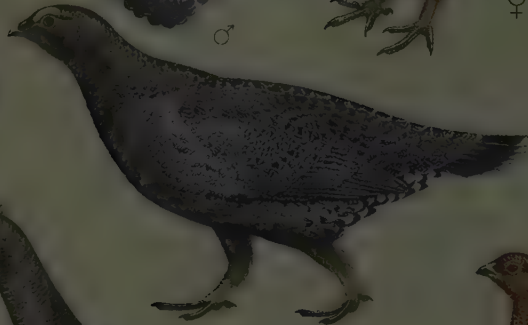
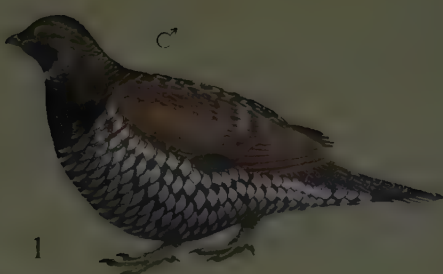
The Caucasian Black Grouse is the only species of the family that is currently considered globally threatened. Intensive grazing of subalpine meadows, predation of young birds by sheepdogs and hunting are apparently the causes of the species' decline, and even local extinction, in many parts of its rather restricted range.

[Tetrao mlkosiewiczzi.
Photo: Chris Catton/
Survival]



PLATE 36

inches 8
cm 20



Genus *FALCIPENNIS* Elliot, 1864

1. Siberian Grouse

Falcipennis falcipennis

French: Tétrás de Sibérie **German:** Sichelhuhn **Spanish:** Gallo Siberiano
Other common names: Sharp-winged Grouse, Siberian/Asian Spruce Grouse

Taxonomy. *Tetrao falcipennis* Hartlaub, 1855, southern shores of Sea of Okhotsk and Stanovoy Mountains.

Closely related to *F. canadensis*, with which forms superspecies; these two often included in *Dendragapus*, but probably merit generic separation (see page 376). Birds from Sakhalin I were described as race *muratai*, but differences are very slight. Monotypic.

Distribution. E Transbaikalia and S Yakutia E to Sea of Okhotsk, and S to Little Chingan Mts, lower Amur region and Sikhote-Alin Mts; Sakhalin I.



Descriptive notes. 38-43 cm; c. 700 g. Mostly rich brown and black; white line around black throat; bill black, combs reddish. Differs from *F. canadensis* in underparts barred black and white; outer primaries narrow and pointed. Female much paler than male, with extensive light spots and streaks above and below, and with strong russet tones, especially on head and neck. First-winter male like adult male, but with brown spots on upperparts and pale ochre shaft streaks; juvenile similar to female.

Habitat. Coniferous forests, mainly of spruce (e.g. *Picea jezoensis*) and fir (*Abies nephrolepis*). Prefers moist, shady areas alternat-

ing with coppices of spruce and larch (*Larix*) and open glades; also favours thick understorey of moss and berries (*Vaccinium*, *Empetrum*, *Rubus*, *Ribes*).

Food and Feeding. Diet based heavily on spruce and fir needles, especially during winter. In summer and autumn, also berries and leaves of *Vaccinium*, *Empetrum*, *Rubus* and other shrubs, as well as some insects. Juveniles feed mostly on insects, changing gradually to berries, and, from late summer, to fir needles.

Breeding. Laying May-Jun. Promiscuous; males dispersed. Nest is depression on ground, with simple lining. Lays 6-10 eggs; incubation period unknown; chicks' down as in *F. canadensis*, mostly buff and brown above, with black-bordered cap.

Movements. Sedentary; seasonally performs limited vertical movements in some mountain areas.

Status and Conservation. Not globally threatened. Included in USSR Red Data Book in 1978, and global status should probably be revised. Has relatively small range and nowhere seems to be common, e.g. densities of 0.25 birds/km² in Slendyi Basin, and 3 pairs/km² in Bikin Range. Disappears rapidly from recently colonized areas, apparently because does not fear man, and is excessively confiding.

Bibliography. Abramov (1962), Cheng Tso-hin (1987), Dementiev & Gladkov (1952), Etchécopar & Hile (1978), Flint *et al.* (1984), Johnsgard (1983a), Judakov (1972), Kirikov (1975), Kirikov & Schubnikova (1968), Kuz'mina (1992), Meyer de Schauensee (1984), Potapov (1985), Potapov & Flint (1989), Pukinskij & Nikanorov (1974), Raethel (1988), Stepanyan (1962), Yamashina (1939).

2. Spruce Grouse

Falcipennis canadensis

French: Tétrás du Canada **German:** Tannenhuhn **Spanish:** Gallo Canadiense
Other common names: Canada Grouse; Franklin's Grouse (*franklinii*)

Taxonomy. *Tetrao canadensis* Linnaeus, 1758, Hudson Bay.

Closely related to *F. falcipennis*, with which forms superspecies; these two often included in *Dendragapus*, but probably merit generic separation (see page 376); present species formerly awarded monotypic genus *Canachites*. Occasional hybrids are known with *Dendragapus obscurus*, *Lagopus lagopus* and *Bonasa umbellus*. Race *osgoodi* often included in nominate. Six subspecies currently recognized.

Subspecies and Distribution.

F. c. osgoodi (Bishop, 1900) - Alaska (Yukon and Kowak Valleys) and NW Canada E to Great Slave L. and L. Athabaska.

F. c. atratus (Grinnell, 1910) - S Alaska (Bristol Bay to Cook Inlet and Prince William Sound).

F. c. canadensis (Linnaeus, 1758) - Canada from C. Alberta to Labrador Peninsula.

F. c. canace (Linnaeus, 1766) - SW Canada (S. Manitoba to New Brunswick and Nova Scotia) and NE USA (N. Minnesota to E. Maine).

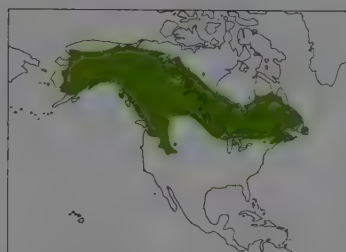
F. c. torridus Uttal, 1939 - Nova Scotia.

F. c. franklinii (Douglas, 1829) - SE Alaska and British Columbia through N. Rocky Mts to C. Idaho and NW Wyoming.

Introduced (*canadensis*) to Newfoundland.

Descriptive notes. 38-43 cm; male 550-650 g, female 450-550 g. Dark grouse, mainly grey above and black below, with white spots along sides, and throat bordered with white. Lacks white bars in underparts and attenuated outer primaries of *F. falcipennis*; lacks cervical sacs of *Dendragapus obscurus*. Bill blackish sepia; combs scarlet in both sexes, becoming geranium red in males during courtship. Female paler, extensively barred, with throat and breast tawny to whitish, sides predominantly ochraceous and underparts barred brown and white; two colour morphs, grey and red. First-winter bird like adult, but two outer primaries more pointed than others and buffier. Juvenile resembles adult female, with white or buff markings at tips of wing coverts and remiges. Races differ mainly in extent of white on underparts and on tail pattern.

Habitat. Distribution largely coincides with boreal coniferous forest; linked mainly with pine (*Pinus banksiana*, *P. contorta*), but also spruce (*Picea mariana*, *P. glauca*, *F. rubens*), fir (*Abies balsamea*) and others. Apparently prefers young successional stands: rather dense, 7-14 m in height, with relatively well developed middle storey. Also, at least during summer, rich understorey of blueberries (*Vaccinium*) and other low shrubs. Territorial males select somewhat open stands. More of a generalist in winter.



Food and Feeding. During winter, mainly pine or spruce needles or both, constituting up to 100%. Summer and autumn food of adults is mostly growing tips, leaves, flowers and berries of blueberry, crowberry (*Empetrum nigrum*) and other ground vegetation. Locally, larches, e.g. *Larix laricina*, important in autumn. Chicks under 1 week old subsist entirely on arthropods, but soon change to berries, and in autumn to needles. Fungi may be important for chicks. Forages throughout day, with peaks in early morning and late afternoon.

Breeding. Laying mostly in Jun. Promiscuous;

males dispersed. Nest is simple depression, lined with dead needles or leaves and some feathers, well concealed by overhead cover, usually at base of a pine or spruce. Lays 5-6 eggs (4-7); incubation 23-24 days; downy chicks not unlike those of *Lagopus*, rufous above, with chestnut brown cap bordered with black; already has primaries 1-7 at hatching, first one shed at c. 19 days; chicks flutter up from ground at 1 week. Clutches that hatch, 40-80% in different studies, less in *franklinii*; average brood 3.2-5.5. In first year, most females (71-100%) lay, but only 40-50% of males defend territories. Annual adult survival rates: 32-44% in male, 23-49% in female; in *franklinii*, 75% in male, 63% in female. Three ringed birds at least 13 years old.

Movements. Largely sedentary. In SW Alberta 25% of adults (35% of females, 7% of males) undertake annual movements of up to 11 km between breeding and wintering grounds, but scarcely synchronized and without definite direction. In Alaska, average autumn movements in adults are of 0-9 km. Most movements at dawn and dusk.

Status and Conservation. Not globally threatened. Widespread and still fairly common throughout most of range. Estimated densities include 8-12 birds/km² in SC Alaska, up to 50 birds/km² in SW Alberta, and up to 38 birds/km² in Ontario. Some range contractions only in SE limits (Michigan, Minnesota, Wisconsin, S. Ontario) due to cutting of original conifer woodland, but species has recolonized some areas of secondary growth. Modern industrial forestry is clearly harmful, although clear-cut logging can, like fire, improve habitat, if carried out on small scale. Commonly hunted; annual bag figures at end of 1970's were of c. 188,000 birds in USA and c. 360,000 in Canada; apparently unlikely to affect populations seriously.

Bibliography. Allan (1985), Alway & Boag (1979), Amman (1963b), Anderson (1973), Boag (1991), Boag & Schroeder (1987, 1992), Boag *et al.* (1979, 1983), Crichton (1963), Ellison (1966, 1968, 1971, 1972, 1973, 1974, 1975, 1976), Ellison & Weeden (1979), Fenna & Boag (1974), de Franceschi & Boag (1991), Gurchinoff & Robinson (1972), Haas (1974), Hedberg (1980), Herman (1980), Herzog (1977a, 1978), Herzog & Boag (1978), Herzog & Keppie (1980), Hohf *et al.* (1987), Johnsgard (1973), Jonkel & Greer (1963), Keppie (1975a, 1975b, 1977a, 1977b, 1979, 1982, 1987a, 1987b, 1991), Keppie & Herzog (1978), Keppie & Towers (1990), Lattner (1982), Lemay (1989), Lumsden (1961a), Lumsden & Weeden (1963), MacDonald (1968), McCourt (1969), McCourt & Keppie (1975), McCourt *et al.* (1973), McKinnon (1983a, 1983b), McLachlin (1970), Naylor (1989), Naylor & Bendell (1987, 1989), Naylor *et al.* (1988), Nugent & Boag (1982), Pendergast (1969), Pendergast & Boag (1970, 1971, 1973), Pietz & Tester (1982), Quinn & Keppie (1981), Ratti *et al.* (1984), Redmond *et al.* (1982), Robinson (1969, 1980), Schroeder (1985a, 1985b, 1986), Schroeder & Boag (1985, 1991), Smyth & Boag (1984), Stepanyan (1962), Stoneberg (1967), Szuba (1989), Szuba & Bendell (1982, 1984, 1988), Terres (1980), Towers (1988), Zwickel & Brigham (1970, 1974).

Genus *DENDRAGAPUS* Elliot, 1864

3. Blue Grouse

Dendragapus obscurus

French: Tétrás sombre **German:** Felsengebirgshuhn **Spanish:** Gallo de las Rocosas
Other common names: Dusky Grouse (SE races); Sooty Grouse (W races)

Taxonomy. *Tetrao obscurus* Say, 1823, "Defile Creek", Colorado.

Perhaps close to genus *Falcipennis*, with which often merged (see page 376). Exceptional hybrids known with *Falcipennis canadensis*, *Tympanuchus phasianellus* and *Centrocercus urophasianus*. W coast races (*sitkensis*, *fuliginosus*, *howardi*, *sierrae*) formerly considered separate species, *D. fuliginosus*. Eight subspecies usually recognized.

Subspecies and Distribution.

D. o. sitkensis Swarth, 1921 - Alexander Archipelago (SE Alaska) to Queen Charlotte Is. (British Columbia).

D. o. fuliginosus (Ridgway, 1873) - coastal mountains from SE Alaska and S. Yukon to NW California; Vancouver I.

D. o. sierrae Chapman, 1904 - inner coastal ranges from C. Washington to California (Sierra Nevada).

D. o. howardi Dickey & van Rossem, 1923 - California, from S. Sierra Nevada S. to Tehachapi Mts and Mt Pinos.

D. o. richardsonii (Douglas, 1829) - S. Yukon and N. British Columbia through W. Alberta and E. British Columbia to N. Idaho and NW Wyoming.

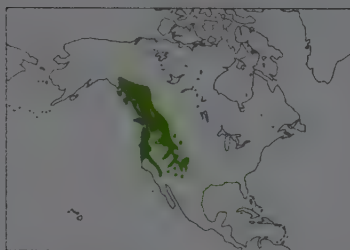
D. o. pallidus Swarth, 1931 - S. British Columbia through E. Washington to NE. Oregon.

D. o. obscurus (Say, 1823) - Rocky Mts from C. Wyoming through Utah and Colorado S. to N. Arizona and W. New Mexico.

D. o. oreinus Behle & Selander, 1951 - NE Nevada.

Descriptive notes. Male 47-57 cm, c. 1300 g; female 44-48 cm, c. 840 g. Relatively large grouse; male mostly grey or slate-coloured, lacking black breast of *Falcipennis canadensis*; long, square tail has grey terminal band, except in races *pallidus* and *richardsonii*; cervical sacs thick, caruncled and near but yellow in coastal males (*fuliginosus* group), smoother and vinaceous to purplish during courtship in inland males (*obscurus* group); combs yellow in male, changing to orange and bright red during display. Female browner, barred on top of head, nape, scapulars, breast and flanks. Immature differs from adult in having more brownish back and wings, and shorter, narrower rectrices; juvenile superficially like adult female, with pale shaft streaks on upperparts, wings and tail, and narrow, pointed rectrices brown.

Habitat. Wide range of habitats in mountain zones; occurs from sea-level up to c. 3600 m, on average breeding at lower altitudes and spending winter in montane, often subalpine coniferous



forest. Distribution apparently associated with Douglas fir (*Pseudotsuga menziesii*) and true firs (*Abies*). Breeding habitat usually forested, but relatively open and dry; irregular relief and maximum amount of edge vegetation preferred, as well as variety of shrubs and presence of some deciduous trees, e.g. aspens (*Populus tremuloides*). In inland areas may occur in shrub-steppe and grassland areas, if not far from trees.

Food and Feeding. During winter almost entirely needles, but also buds, twigs and cones, of firs (*Pseudotsuga*, *Abies*), sometimes pines (*Pinus*), hemlocks (*Tsuga*) and, before shedding

needles, larches (*Larix*). Berries and herbaceous plants predominate in summer and autumn; on Vancouver I more than 90% of adult food consists of *Pteridium*, *Salix*, *Mahonia*, *Rubus*, *Vaccinium*, *Gaultheria* and *Hypochaeris*. Chicks take almost exclusively animal food during first 10 days, especially ants, beetles and grasshoppers; later change to berries. Birds tend to forage mostly during last 3 hours of daylight, and in early morning; growing young feed more continuously.

Breeding. Laying May-Jun. Promiscuous; males dispersed. Nest is shallow scrape, lined (often poorly) with dead vegetation and some feathers, usually under small conifers, shrubs, logs or overhanging rocks. Lays 6-8 eggs (4-10); incubation 25-27 days; down of chicks dorsally grey in coastal races and reddish brown in inland ones, mottled with black and brown; already has primaries 1-7 at hatching, first one shed at 16-17 days. Clutches that hatch, c. 60-80% in different studies; in late autumn, average brood 2.2-3.3 in coastal, and 3.2-4.3 in inland populations. At 1 year old, most females breed but few males do so. Annual adult survival rates: 66-75% in males, 40-71% in females; mean estimated longevity after first autumn: 3 years for males, 2 for females.

Movements. Altitudinal shifts between breeding and wintering grounds reported for most areas; in winter usually higher. In Washington, 15 of 30 recoveries occurred more than 8 km from ringing place (maximum 50 km).

Status and Conservation. Not globally threatened. Still occupies most of original range, with some contractions due to urbanization or agriculture. Race *howardi* apparently lost from S part of its range, for unknown reasons. Common throughout, although densities rather variable; usually c. 10 adult males/km² in interior, but values of 10-30 in coastal populations, and up to 83-103 in British Columbia. Mainly affected by forestry, sometimes positively, although temporarily, if this involves clear-cut logging on small scale; impact of forest exploitation in wintering montane areas should be investigated. Although a popular game bird everywhere, with annual bags of c. 520,000 birds in late 1970's, ringing recovery rates suggest low impact of hunting on populations, perhaps mainly due to autumn migration into rugged terrain. Grazing may be threat in some inland breeding areas of shrub-steppe and forest. Several attempted introductions: successful in parts of Arizona, New Mexico and British Columbia.

Bibliography. Bauer (1962), Beer (1943), Bendell (1954), Bendell & Elliott (1966, 1967), Bendell & Zwickel (1985), Bergerud & Butler (1985), Bergerud & Hemis (1975), Blackford (1963), Boag (1964, 1965, 1966), Brown & Smith (1980), Cude (1985), Cude & Hoffman (1990), Degner (1988), Donaldson & Bergerud (1974), Fowle (1960), Frandsen (1980), Hannon & Zwickel (1979), Harju (1974), Henderson (1960), Hines, J.E. (1986a, 1986b, 1987), Hoffman, R.S. (1961), Hoffman, R.W. (1981), Jamieson (1985), Jamieson & Zwickel (1983a, 1983b), King (1973), King & Bendell (1982), Lance (1970), Lewis (1984a, 1984b, 1984c, 1985), Lewis & Zwickel (1982), Marshall (1946), Martinka (1972), McKinnon & Zwickel (1988), McNicholl (1978), Mussell (1960, 1963), Niederleitner (1987), Pekins (1988), Pekins et al. (1989, 1992), Redfield (1975), Remington (1990), Rensel & White (1988), Ridgway & Friedmann (1946), Rogers (1968), Schladweiler (1968), Sopuck (1979), Standing (1960), Stauffer & Peterson (1985), Stewart, P.A. (1967), Stewart, R.E. (1944), Stirling & Bendell (1970), Stiven (1961), Terres (1980), Wing (1946a, 1946b), Wing et al. (1944), Zwickel (1967, 1972, 1973, 1992), Zwickel & Bendell (1972, 1986), Zwickel & Lance (1965), Zwickel, Boag & Bendell (1989), Zwickel, Buss & Brigham (1968), Zwickel, Degner et al. (1991), Zwickel, Lewis & McKinnon (1988).

Genus LAGOPUS Brisson, 1760

4. Willow Grouse

Lagopus lagopus

French: Lagopède des saules German: Moorschneehuhn Spanish: Lagópodo Común
Other common names: Willow Ptarmigan; Red Grouse (*scoticus*)

Taxonomy. *Tetrao lagopus* Linnaeus, 1758, Swedish Lapland.

Hybrids relatively frequent with *Tetrao tetrix* and *Bonasa bonasia*; occasional with *Tetrao urogalus*. *Falcapennis canadensis* and *L. mutus*. Internal taxonomy confused, due to complicated plumage sequence, and based mainly on colour and pattern of summer plumages. Many races often lumped, although in quite different ways: nominate sometimes considered to include *koreni*, *birulai*, *kamtschatkensis*, *alascensis*, *albus*, *ungavus* and others, from Scandinavia to Quebec; races of SE Siberia also often merged, *sseerebrowsky* in *okadae* and *kozlovae* in *brevisrostris*. Irish birds occasionally awarded separate race, *hibernicus*. Nineteen subspecies currently recognized.

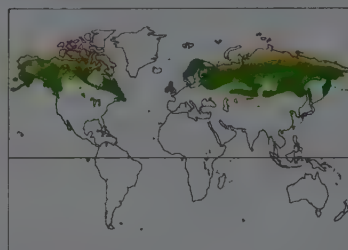
Subspecies and Distribution.

- L. l. scoticus* (Latham, 1787) - British Isles.
- L. l. variegatus* Salomonsen, 1936 - islands off Trondheim, Norway.
- L. l. lagopus* (Linnaeus, 1758) - Scandinavia, Finland, N European Russia.
- L. l. romanus* Serebrowsky, 1926 - Baltic countries and C Russia E to Kama Basin.
- L. l. birulai* Serebrowsky, 1926 - New Siberia Is.
- L. l. koreni* Thayer & Bangs, 1914 - Siberia from Urals and Yamal Peninsula to Pacific, S to Tomsk, Krasnoyarsk, Yakutsk and N coast of Sea of Okhotsk.
- L. l. maior* Lorenz, 1904 - SE Russia, N Kazakhstan and SW Siberia, E to Altai foothills.
- L. l. brevisrostris* Hesse, 1912 - Altai and Sayan Mts.
- L. l. kozlovae* Potenko, 1931 - W Mongolia, in Tannu-Ola, Khangai and Kentei Mts.
- L. l. sseerebrowsky* Domaniowski, 1933 - E Siberia, from L Baikal to Sea of Okhotsk, S to Khingan Mts. and Southern Ural.
- L. l. kamtschatkensis* Momiyama, 1928 - Kamchatka and N Kuril Is.
- L. l. okadae* Momiyama, 1928 - Sakhalin I.
- L. l. muriei* Gabrielson & Lincoln, 1959 - E Aleutian Is and Kodiak I.
- L. l. alexandrei* Grinnell, 1909 - coastal islands of SE Alaska and NW British Columbia.
- L. l. alascensis* Sward, 1926 - Alaska.
- L. l. leucopterus* Taverner, 1932 - Arctic islands of N Canada (Banks, Victoria, Southampton, Baffin) and adjacent mainland.

L. l. albus (Gmelin, 1789) - N Canada, from N Yukon and C British Columbia to Gulf of St Lawrence.

L. l. ungavus Riley, 1911 - N Quebec and N Labrador.

L. l. allenii Stejneger, 1884 - Newfoundland.



Descriptive notes. 36-43 cm; male 535-700 g, female 525-650 g. Rusty brown in summer, with white wings, belly and legs, and black tail; redder than similar *L. mutus* and with slightly heavier bill. All white during winter except for black tail. Plumage patchy during moults, in spring areas of reddish brown still mostly confined to head, neck and breast. Scarlet combs more prominent in spring and during courtship. Female greyer and more heavily barred, with very small combs. First-winter birds already like adults, but with less gloss on two outer primaries. Race *scoticus* has brown flight-feathers and never develops

white winter plumage; in at least two other races, *variegatus* and *gabrielsoni*, some dark feathers are retained during winter; race *scoticus* polymorphic.

Habitat. Primarily Arctic tundra, extending S in alpine mountain ranges and along or below tree-line, in openings of boreal forest. Prefers low, moderately moist areas, rich in low willows (*Salix*) or dwarf birches (*Betula*) in addition to berry-bearing shrubs, mosses, grasses and herbs; avoids rocky or lichen-rich tundra, as well as steep slopes. Male prefers territories in areas with vegetation lower than eye level and elevated sites such as rocks, trees or hummocks for displaying on. Nesting and brooding requirements fairly generalized, chicks using areas with very low vegetation. In winter prefers valley bottoms and riparian thickets of willows or, locally, birches, alders, aspens or spruces, often in forest glades. In British Is, depends on heather (*Calluna vulgaris*) moors, mainly in upland areas but also in bogs with *Eriophorum* and *Sphagnum*; in winter, also found at lower altitudes, sometimes in farmland. In Altai and other ranges in C Asia, occupies subalpine belt of vast thickets of *Betula rotundifolia*. In steppes of SW Siberia and N Kazakhstan was formerly found in relic patches of boreal vegetation, but these much reduced by farming, and where species survives now nests in grain fields.

Food and Feeding. Heavily dependent on willow, especially during winter, e.g. in Alaska, 94% willow buds and twigs, including 80% *Salix alaxensis*; in some areas, e.g. Scandinavia, birch can be preferred. Generally seems to depend less on low shrubs than *L. mutus*, and more on willow and birch; but *Vaccinium* is most important during winter in Newfoundland; heather is staple food all year round in British Is. Diet more varied from spring to autumn, when leaves and berries of *Vaccinium* and *Empetrum* are prominent. Some arthropods also taken in summer, mainly by chicks, although perhaps less often than by other grouse; in Scotland, even chicks under 3 weeks old eat mainly heather.

Breeding. Laying mostly May-Jun; Apr-May in British Is; second half of Jun in N Siberia. Monogamous; male guards incubating female and even broods chicks. Nest is shallow scrape, with thin lining, in thick vegetation, which usually covers it partially. Normally 8-11 eggs (2-15), most often 6-9 in *scoticus*; incubation c. 22 days; downy young with characteristic chestnut crown bordered by black lines, and narrow black line on centre of forehead; primaries, secondaries and greater upperwing-coverts break through on first day, well developed at c. 10 days; first primary shed at 18 days. First breeding at 1 year old. Annual adult survival rate c. 30% in different studies; mean longevity after first autumn, c. 10 months; one ringed bird survived 7 years, 8 months. Hatching success 78-3% in Norway, 82-5% in Scotland; chicks surviving 1 month, on average 54-4% in Norway (39-47-6-2%, depending on year).

Movements. Sedentary in some places, e.g. in Scotland and Scandinavia, where only short range altitudinal movements occur. At least partially migratory elsewhere: in N Siberia may move 200-300 km into forested areas; in North America occasionally reaches latitude of N Minnesota and S Ontario. Date and magnitude of movements may depend on food shortages, perhaps linked with population cycles, and mass migrations have occurred in some years. Females tend to move farther. Very limited daily movements.

Status and Conservation. Not globally threatened. Widespread and common to abundant throughout most of very extensive range. Nevertheless, some range contractions have been detected in parts of Europe, e.g. Baltic countries; these are often attributed to climatic changes. Abundance subject to marked threefold to fivefold fluctuations, often in 10 year cycles. In Canada, densities of c. 0.4-3 adults/km² throughout large areas containing unfavourable habitat, with up to 20-100 males/km² at some particular sites. In Russian tundra often reaches densities of 20-30 pairs/km², and up to 60 pairs/km². Other estimates include 52-95 birds/km² in poor to rich grouse moors in Scotland, 54-116 birds/km² in Norway, and 80 birds/km² in Newfoundland. Populations fluctuate around 200,000 pairs in Sweden, 110,000 in Finland (1958), and 500,000 in British Is (1970's). Most important tetraonid for hunting: in Russian tundra annual bags estimated at c. 8,000,000 birds (2,000,000 W of Ural); less intensively hunted in North America, where total of all *Lagopus* species amounts to c. 300,000 birds (c. 94,000 in Alaska, 200,000 in Canada). Race *scoticus* extensively managed and even bred in captivity for hunting, with up to 2,500,000 birds annually shot around 1911; poor habitat management and other factors reduced this figure to 260,000-600,000 by 1983, but some recovery reported since. Probably tolerates heavy levels of shooting, although important declines in Finland were attributed to excessive hunting. Many attempted introductions have taken place, most of them failing, e.g. *scoticus* in Germany and Belgium.

Bibliography. Andersen (1986), Andreev (1988b, 1991b), Bergerud (1970a, 1970b), Bergerud & Huxter (1969), Bergerud & Mercer (1972), Bergerud & Mossop (1983), Bergerud et al. (1963, 1964, 1970), Brittas (1984, 1988), Brittas & Marström (1982), Browning (1979), Cramp & Simmons (1980), Erikstad (1978, 1985a, 1985b, 1985c, 1986), Erikstad & Andersen (1983), Erikstad & Spidise (1982), Etchécopar & Hùe (1978), Flint et al. (1984), Hannon (1982, 1983, 1984), Hannon & Martin (1992), Hannon & Smith (1984), Hanssen & Utne (1985), Helle (1980), Höglund (1970, 1980), Höhn (1980), Hudson (1985, 1986a, 1986b), Hudson & Dobson (1990), Hudson & Newborn (1990), Irving et al. (1967a, 1967b), Ivantsev (1974), Jenkins et al. (1963, 1964, 1967), Johnson et al. (1991), Jørgensen & Blix (1985), Jurlov (1960), Korhonen (1980, 1989), Kratzig (1940), Kuz'mina (1992), Lance (1978a, 1978b, 1983), Lance & Lavton (1990), Lawton (1990), Lindén (1981b), Marström & Höglund (1981), Martin (1985, 1989, 1991), Martin & Hannon (1987), Martin & Hik (1992), Martin et al. (1989, 1990), Mercer (1967), Mischev (1948), Miller (1968), Miller & Watson (1978), Miller et al. (1970), Moss (1969, 1972a, 1972b, 1973, 1974), Moss & Watson (1980, 1991b), Moss, Trenholm et al. (1990), Moss, Watson & Pan (1974, 1975), Moss, Watson & Rothery (1984), Moss, Watson et al. (1981), Mossop (1988b), Myrberget (1970, 1972, 1974, 1975, 1976, 1977, 1979, 1984, 1985, 1987, 1988, 1989), Myrberget & Skar (1976), Myrberget et al. (1977, 1985), Nazarov & Subnikova (1971), Niemela (1974), Niethammer (1958), O'Reilly & Hannon (1989), Parker (1981), Pedersen (1984, 1990), Pedersen & Stoen (1979, 1988), Pedersen et al. (1983), Peters (1958), Phillips et al. (1992), Potts et al. (1984), Pulliam (1968, 1975, 1978), Pulliam & Hyman (1981), Pulliam & Tanaka (1983, 1991), Reimann (1991), Rugvåg & Freimann (1946), Robb et al. (1992), Rodionov (1969), Rogacheva (1992), Rovik et al. (1990), Sæther (1989), Savory (1977, 1978), Schieck & Hannon (1989, 1992), Slagstad (1975), Spidise (1980), Stoen et al. (1985, 1992), Stokkan (1979), Stokkan & Stoen (1980), Terres (1980), Thomas (1984), Utjanin (1949), Valanne (1966), Veronin (1991), Watson

(1967, 1982, 1985), Watson & Jenkins (1964), Watson & Miller (1976), Watson & Moss (1980), Watson, Moss & Parr (1984), Watson, Parr & Lumsden (1969, 1984), Weeden (1963, 1964, 1979), West & Meng (1966, 1968), Westenskov (1956), Wise (1982).

5. Rock Ptarmigan

Lagopus mutus

French: Lagopède alpin German: Alpenschneehuhn Spanish: Lagópodo Alpino

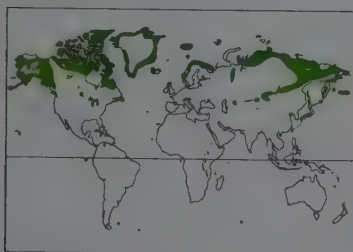
Taxonomy. *Tetrao mutus* Montin, 1776, Sweden.

Occasional hybrids known with *L. lagopus*, *Tetrao tetrix* and *Bonasa bonasia*. Very complex internal taxonomy, largely due to complicated moults. Many races vary only slightly in colour and pattern of summer plumage; sometimes lumped, though in rather different ways: races *komensis pleskei* and *transbaicalicus* sometimes included in *kelloggae*, or all of these in *nelsoni*, with possible addition of *krascheninnikovi* and *kurilensis*; race *reinhardi* sometimes included in *rupestris*, *macrorhynchus* in *nadezdae*, and *pyrenaicus* in *helveticus*. Thirty subspecies currently recognized.

Subspecies and Distribution.

- L. m. hyperboreus* Sundevall, 1845 - Svalbard (Spitsbergen), Franz Josef Land and Bear I.
- L. m. mutus* (Montin, 1776) - Norway, N Sweden, N Finland and Kola Peninsula.
- L. m. millaisi* Hartert, 1923 - Scotland.
- L. m. pyrenaicus* Hartert, 1921 - Pyrenees.
- L. m. helveticus* (Thienemann, 1829) - Alps, from Savoie to C Austria.
- L. m. komensis* Serebrovsky, 1929 - N Ural.
- L. m. pleskei* Serebrovsky, 1926 - N Siberia, from Taimyr Peninsula to Chukotsky Peninsula.
- L. m. macrorhynchus* Serebrovsky, 1926 - Tarbagatai.
- L. m. nadezdae* Serebrovsky, 1926 - mountains of S Siberia and Mongolia (Altai, Sayan, Khangai and others).

- L. m. transbaicalicus* Serebrovsky, 1926 - SE Siberia, from L. Baikal to Sea of Okhotsk.
 - L. m. krascheninnikovi* Potapov, 1985 - Kamchatka.
 - L. m. ridgwayi* Stejneger, 1884 - Commander Is.
 - L. m. kurilensis* Kuroda, 1924 - Kuril Is.
 - L. m. japonicus* Clark, 1907 - C Honshu (Japan).
 - L. m. evermanni* Elliot, 1896 - Attu I (Aleutian Is.).
 - L. m. townsendi* Elliot, 1896 - Kiska I (Aleutian Is.).
 - L. m. gabrielsoni* Murie, 1944 - Amchitka I (Aleutian Is.).
 - L. m. sanfordi* Bent, 1912 - Tanaga I and Kanaga I (Aleutian Is.).
 - L. m. chamberlaini* Clark, 1907 - Adak I (Aleutian Is.).
 - L. m. aikensis* Turner, 1882 - Atka I (Aleutian Is.).
 - L. m. yunaskensis* Gabrielson & Lincoln, 1959 - Yunaska I (Aleutian Is.).
 - L. m. nelsoni* Stejneger, 1884 - Unimak, Unalaska and Amaknak Is (Aleutian Is.).
 - L. m. dixonii* Grinnell, 1909 - Glacier Bay islands and adjacent mainland (SE Alaska).
 - L. m. kelloggae* Grinnell, 1910 - Alaska and N Yukon.
 - L. m. rupestris* (Gmelin, 1789) - N Canada, from Melville I and Ellesmere I to C British Columbia, S Mackenzie, Southampton I, N Quebec and Labrador.
 - L. m. captus* Peters, 1934 - E Greenland.
 - L. m. saturatus* Salomonsen, 1950 - NW Greenland.
 - L. m. reinhardi* (C. L. Brehm, 1824) - SW Greenland.
 - L. m. welchi* Brewster, 1885 - Newfoundland.
 - L. m. islandorum* (Faber, 1822) - Iceland.
- In 1992, a very small population of what appears to be a still undescribed race was discovered in Pamir Alai Mts, Tajikistan.



Descriptive notes. 33-38 cm; male 470-740 g; female 430-700 g. In summer, brown plumage like *L. lagopus*, but greyer, without reddish tones. During winter, all white; male has characteristic, conspicuous black laral stripes. Female even more difficult to separate from *L. lagopus*; slightly more yellowish grey, less rusty; in both sexes bill is slightly smaller. First-winter birds like adults, but outer two primaries differ in amount of pigment. Races separated mainly on slight differences in colour and pattern of summer plumage.

Habitat. Rocky tundra with fairly sparse vegetation, or alpine summits. More highly specialized for high Arctic conditions than *L. lagopus*; on average, lives farther N, up to 83° N on Ellesmere I and in N Greenland, and at higher altitudes. Rarely in areas of high shrubs or below tree-line. In Scotland, commonest in areas with large boulders or outcrops, in stunted heather, sometimes mixed with herbaceous vegetation. Almost always above 2000 m in S mountains, e.g. Alps and Pyrenees; above 5000 m in Pamir Alai. Since more dependent on ground vegetation for food than *L. lagopus*, during winter lives in less snowy regions, or looks for windswept ridges and slopes.

Food and Feeding. Winter food mainly taken from ground; varies greatly between localities, also depending on snow conditions. In Alaska, mainly buds and catkins of dwarf birch (*Betula*), followed by buds and twigs of willow (*Salix*); but in Iceland willows are preferred, probably because *L. lagopus* absent; *Vaccinium*, *Empetrum* and other berry-bearing shrubs are main winter food in Alps and other S areas. Diet usually much more varied from spring to autumn, consisting of leaves, flowers, berries and seeds of many plants, e.g. *Vaccinium*, *Empetrum*, *Arctostaphylos*, *Rhododendron*, *Geum*, *Carex*, *Polygonum*, *Equisetum*, *Dryas*, *Draba*, *Saxifraga*, etc.

Breeding. Laying mostly Jun, from late May in Scotland, from mid-Jun in Spitsbergen. Monogamous; male guards nest and incubating female, but not brood. Nest is shallow depression, scantily lined with grass, twigs, leaves and some feathers, usually in open, sheltered by large stone or shrub. Normally 5-8 eggs (3-11) in Scotland, and average of 6.4-9.0 in Alaska, varying with year; incubation 21-24 days; downy young similar to those of *L. lagopus*, also with brown crown bordered by black lines, but brown areas less rufous and pale patches greyer. Flight-feathers in growth at hatching; chicks able to fly at c. 10 days; first primary shed at 3 weeks. In Alaska, c. 67% of nests hatch and average brood size in Aug 4.8-6.1 in different years, 100% of 24 nests hatched in Scotland, where average brood size when chicks fully-grown is 1.2-6.2. Age of first breeding 1 year old; 38% survival rate from Aug to spring.

Movements. Most populations, including mountain ones, make only very limited movements, largely altitudinal and depending on local conditions and weather. Greater movements in Arctic populations, perhaps mostly nomadic or eruptive; one bird recovered over 1000 km S in Greenland. In North America, females reported to travel farther S and return later to breeding grounds.

Status and Conservation. Not globally threatened. Remoteness of habitat makes species relatively secure. A limited range contraction has been documented in Great Britain since end of 19th century, with local extinctions in Outer Hebrides, Rhum, Arran, SW Scotland, and English Lake District, perhaps due to excessive grazing by sheep. Densities change greatly, often in cyclical fashion: e.g. 5-18 birds/km² in one study area in Scotland, and 2.3-4.3 males/km² in another in Alaska. Apparently more stable in Alps, where 3-4 territories/km² estimated for good areas in Italy, and c. 5 males/km² for parts of Switzerland. In Japan, 15-16 birds/km²; in Taimyr, 6-8 birds/km²; in Kolyma region, 0.5-2.2 birds/km². Population estimates include c. 75,000 pairs in Sweden, 4000 in Finland, 10,000 in Scotland, less than 10,000 in France, and 7000-10,000 in Italy. Hunting probably does not affect populations except in small, isolated areas, where loss of habitat and increasing disturbance due to mountain tourism and ski-ing can locally be negative factors.

Bibliography. Alamiary & de Juan (1983), Andreev (1971, 1975b), Bernard (1982b), Bernard-Laurent (1983, 1987), Bossert (1976, 1977, 1980), Bossert *et al.* (1983), Boudarel (1985, 1987, 1988, 1989), Boudarel & Garcia (1991), Brazil (1991), Brodsky (1988), Canut, Garcia & Marco (1987), Chiba (1965), Cotter *et al.* (1992), Cramp & Simmons (1980), Desmet (1988), Dyck (1979), Emison & White (1988), Eichécupar & Hue (1978), Fasel & Zhindén (1983), Flint *et al.* (1984), de Franceschi (1986, 1988), Garcia *et al.* (1987), Gardarsson (1971, 1988), Gardarsson & Moss (1970), Gasaway (1976), Gasaway *et al.* (1975, 1976), Gelting (1937), González & Novoa (1989), Grammelveldt & Steen (1978), Gudmundsson (1960), Höhn (1980), Holder & Montgomerie (1993), Jacobsen *et al.* (1983), Kuc (1964), Kuz'mina (1992), MacDonald (1970), Marti & Bossert (1985), Martinez (1985), Montensen *et al.* (1983, 1985), Moss (1968, 1969, 1973, 1974), Moss & Watson (1984), Osti (1981), Pfeffer (1992), Pulliainen (1970b, 1970c), Ridgway & Friedmann (1946), Rogacheva (1992), Sakurai (1972), Sakurai & Tsuruta (1972), Salomonsen (1939, 1950), Shodnikov (1957), Scherini (1977), Scherini & Tosi (1978), Soikiro *et al.* (1969), Steen & Unander (1985), Stokken *et al.* (1986), Terres (1980), Thaler (1983), Theberge (1971), Theberge & Bendell (1980), Theberge & West (1973), Thomas (1984), Thomas & Popko (1981), Unander & Steen (1985), Unander *et al.* (1985), Watson (1964, 1965, 1972, 1973, 1982), Watson & Shaw (1991), Watson *et al.* (1969), Weeden (1963, 1964, 1965, 1966, 1969, 1972), Weeden & Theberge (1972), Weeden & Watson (1967), West (1972), Williams *et al.* (1980).

6. White-tailed Ptarmigan

Lagopus leucurus

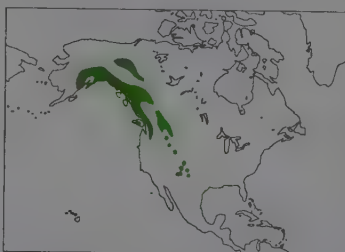
French: Lagopède à queue blanche German: Weischwanz-Schneehuhn Spanish: Lagópodo Coliblanco
Other common names: Snow Grouse

Taxonomy. *Tetrao (Lagopus) leucurus* Richardson, 1831, Rocky Mountains, lat. 54° N. Validity of races questionable; all may be invalid. Five subspecies normally recognized.

Subspecies and Distribution.

- L. l. peninsularis* Chapman, 1902 - mountains in Alaska, Yukon and Mackenzie, S to Kenai Peninsula and S Yukon.
- L. l. leucurus* (Richardson, 1831) - Rocky Mts in British Columbia and SW Alberta.
- L. l. saxatilis* Cowan, 1939 - Vancouver I.
- L. l. rainierensis* Taylor, 1920 - Cascade Range, Washington.
- L. l. alipitensis* Osgood, 1901 - Rocky Mts, from Montana to N New Mexico.

Introduced (*alipitensis*) in parts of Oregon, California, Utah and New Mexico.



Descriptive notes. 31-34 cm; c. 325 g. Only *Lagopus* with all white tail. Winter plumage completely white; during summer both sexes have body mottled or barred with black, brown and buff, retaining white on wings, tail, belly and legs. Female in summer has larger buff margins on body feathers, resulting in a yellowish, more regularly barred pattern on back and sides. Immature shows some black pigment on outer two primaries. Racial variation clinal in both size and coloration: birds smaller in N, larger in S; breeding plumage darkest in S half of range, greyest in N.

Habitat. Alpine tundra; in Alaska, typically on steep slopes and ridges, often around cirques, with numerous rocky outcrops, and low, generally sparse vegetation, in which shrubs nearly absent. In Montana, prefers relatively flat areas above 2000 m, with rocks and moist ledges where alpine vegetation low but well developed; avoids boggy areas or shrubby vegetation over 45 cm high. In Colorado, both spring and winter distributions mainly conditioned by presence of alpine willows (*Salix nivalis*, *S. angulorum*) in snow-free areas. Nests mostly near tree-line, on moderate slopes.

Food and Feeding. In Alaska, where competes with the other two *Lagopus*, much of winter food consists of alder catkins (*Alnus*); willow (*Salix*) and birch (*Betula*) less important. In Colorado, alpine willows appear in 100% of food samples, while alder only locally abundant. In spring and summer, apart from willow leaves, important food includes leaves and flowers of *Ranunculus*, *Dryas*, *Potentilla*, *Saxifraga*, and bulbs of *Polygonum*. During first 2 weeks of life chicks feed largely on invertebrates. In some areas berries of *Empetrum nigrum* and *Vaccinium* eaten in autumn.

Breeding. Laying in Jun. Usually monogamous; male remains with female until hatching; pair-bond often lasts for more than one season. Frequently nests among or near rocks or boulders; nest is shallow depression, lined with materials gathered within 40 cm of nest. Lays 5-6 eggs (2-9); incubation 22-23 days; downy young less rufous above than other *Lagopus*, with less marked chestnut crown with black margins; chicks can fly at c. 10 days; first primary shed at c. 17 days. Clutches that hatch, 70% in Montana, 57% in Colorado. First breeds at 1 year. Annual adult survival rate 71%; estimated mean longevity after first summer 3 years; estimated maximum longevity 13-15 years.

Movements. Only limited altitudinal movements in winter. Females and subadults move further on average, e.g. in Colorado, adult males move under 2.5 km, whereas subadult females 8.5 km, maximum 22-27 km.

Status and Conservation. Not globally threatened. Highly disjunct range throughout Rocky Mts makes some small S populations vulnerable, e.g. in New Mexico, where once found on all alpine ridges of Sangre de Cristo Mts, but presently occurs only around a few peaks. In Colorado, where more than 10,000 km² are occupied by species, densities average c. 6.5 birds/km² (2-12), with low amplitude cycles. Annual hunting bag in Colorado was of c. 1000 birds in 1970-1974, so shooting probably does not represent a relevant threat in general. Several introduction attempts have been successful.

Bibliography. Bridbury (1915), Braun (1969, 1985), Braun & Rogers (1971), Braun, Hoffman & Rogers (1976), Braun, Martin & Robb (1993), Braun, Nish & Giesen (1978), Braun, Schmidt & Rogers (1973), Choute (1960, 1963a, 1963b), Clarke & Johnson (1992), Frederick & Gutiérrez (1992), Giesen (1977), Giesen & Braun (1979a, 1979b, 1979c, 1992, 1993), Giesen *et al.* (1980), Hertzog *et al.* (1970), Hertzog, Hoffman & Braun (1965, 1970), Hoffman & Giesen (1983), Jensen & Ryder (1965), Martin *et al.* (1990), May (1975), May & Braun (1972), Moss (1973, 1974), Quick (1947), Ridgway & Friedmann (1946), Root (1988), Schmidt (1969, 1988), Scott (1982), Terres (1980), Weeden (1967).



Genus *TETRAO* Linnaeus, 1758

7. Eurasian Black Grouse

Tetrao tetrix

French: Tétrás lyre

German: Birkhuhn

Spanish: Gallo-lira Común

Other common names: Blackcock (male); Greyhen (female)

Taxonomy. *Tetrao Tetrix* Linnaeus, 1758, Sweden.

Often placed in genus *Lyrurus* together with *T. mlokosiewiczii*, with which forms superspecies. Commonly hybridizes with *T. urogallus*, and quite often with *Lagopus lagopus*, both hybrids even receiving vernacular names; also occasionally with *L. mutus* and *Bonasa bonasia*. Race *tschusti* often included in *viridanus*, and *baikalensis* in *ussuriensis*. Seven subspecies currently recognized.

Subspecies and Distribution.

T. t. britannicus (Witherby & Lönnberg, 1913) - N & W Great Britain.

T. t. tetrix Linnaeus, 1758 - most of range, from Scandinavia, Belgium and Alps of S France to NE Siberia (R. Kolyma).

T. t. viridanus Lorenz, 1891 - SE Russia and SW Siberia, between R Don and R Irtysh.

T. t. tschusti Johansen, 1898 - S Siberia, from R Irtysh to L Baikal, N to Tomsk and Krasnoyarsk, S to NW Altai and Sajan Mts.

T. t. baikalensis Lorenz, 1911 - SE Siberia, from L Baikal to Amurland, S to N Mongolia and NW Manchuria.

T. t. mongolicus Lönnberg, 1904 - Kirgizh and Tien Shan E to Altai and other ranges in W Mongolia.

T. t. ussuriensis Kohts, 1911 - Manchuria, from Khingan (Chingan) Mts to R Ussuri and NE Korea.

Descriptive notes. Male c. 60 cm. 1100-1250 g (up to 1800 g); female, c. 45 cm. 750-1100 g. Glossy black, with blue or green reflections, contrasting with white in rounded carpal patch, prominent wingbar and undertail-coverts; peculiar lyre-shaped tail, with outer feathers long and curved outwards; scarlet combs. In late summer, feathers on head and neck mottled or barred brown, and some white on throat. Female largely brown, heavily barred black; darker than *T. urogallus*, with thin white wingbar and shorter tail, slightly forked when closed. First-winter birds like adults, but male browner and duller, with outer tail feathers less curved; in both sexes, two outermost primaries more sharply pointed and more vermiculated at tips. Races vary clinally in size, colour of gloss in male and general coloration of female.

Habitat. Highly variable throughout wide range, but typically found in transition area between forests and open environments, e.g. steppes, heaths, moors, bogs and marginal cultivation. From N edge of boreal forest to brushwood steppe zone or locally semi-desert; in lowlands and mountains, up to 2000 m in Alps, 3000 m in Tien Shan. In N Europe, deciduous or mixed forests preferred to coniferous ones, and sparse, young stands to older, denser ones; but in S mountains, e.g. Alps, mainly occupies moderately dense forest of spruce and fir, or larch. In many areas appears to select birches (*Betula pubescens*, *B. verrucosa*). Good breeding habitat usually contains a high diversity of plants.

Food and Feeding. In many places favourite winter food is birch catkins, followed by birch buds and shoots, and needles, cones and male flowers of conifers, e.g. *Pinus sylvestris* and *P. mugo*. In less snow-covered areas in S of range, e.g. Scotland and Netherlands, greater winter use of shrubs (*Calluna*, *Rhododendron*, *Vaccinium*) and grasses. During spring, importance of birch declines in favour of berries, stems and shoots of *Vaccinium myrtillus*, *V. uliginosum*, *V. vitis-idaea*, *Empetrum nigrum*, *Calluna vulgaris*, *Juniperus communis*, *Polygonum viviparum*, etc. Chicks of under 100 g eat mostly insects, especially ants; older ones switch to berries, drupes, nutlets, etc. Shift to tree-feeding in winter is probably related to amount of food on ground, leaf conditions of trees and weather and snow conditions.

Breeding. Laying May-Jun. Promiscuous; males form leks. Nests amongst scrub or tall vegetation, often at base of tree, between roots, under low branches or against a boulder; nest is a shallow scrape, usually lined with some plant material and feathers. Average 8 eggs (6-11) in Finland; incubation 25-27 days; downy chick has brown cap surrounded by black line, reminiscent of *Lagopus*; flight-feathers develop from 1st day, and chicks capable of flight at 10-14 days; first primary shed at c. 15 days. In two studies in Finland, 71% clutches hatched and 62% chicks survived until late Aug. Sexual maturity in first year, but males probably rarely mate even during second. Annual survival rate 40-60% (Finland); one ringed female survived at least 5-5 years.

Movements. Largely sedentary, although apparently eruptive in some N areas at long intervals, when large flocks (females heavily outnumbering males) may move hundreds of kilometres; furthest recovery over 1000 km, in Sweden. Regular winter migrations reported in parts of Siberia (Ussuri, Amur). In Norway, males recovered at 1-6 km on average, females at 4-4 km. In general, daily movements limited, but in steppes of N Kazakhstan, regular flights of up to 30 km said to occur.

Status and Conservation. Not globally threatened. Major declines and range contractions reported all over Europe, except in Alps and N. Following some expansion during 19th century, species presently very scarce in most of C Europe: e.g. in Denmark from c. 2500 birds in 1964 to 280-360 in 1977; in Netherlands from c. 3000 birds in 1964 to 280-360 in 1977. In Alps, where typical densities appear to be 1-5-7 males/km², population may be stable: less than 1000 pairs in France, c. 40,000 birds at end of summer in Italy, c. 14,000 birds in Austria. Much commoner, although also decreasing, in Fenno-Scandia, with possibly 500,000 birds in Norway, c. 300,000 pairs in Sweden, and c. 900,000 pairs in Finland, where densities may average 1-3 males/km². In Russia, numbers and range diminishing in S, but apparently increasing in N. In Ukraine, now scarce, occurring only in Poles'ye zone and Carpathians; protected in many areas, and species not hunted. Logging in mature woodland tends to favour present species, but increased cultivation, afforestation of heathlands, removal of birch stands and imposition of coniferous monocultures have negative effects. Locally, species also suffers from excessive hunting, disturbance at leks and other factors. Hunting figures, mostly from late 1970's, include annual bags of 1200-1500 males in Switzerland, 1700 males in Austria, 1200-1600 males in Poland, 19,000 birds in Norway, 21,600 in Sweden and 54,000-171,000 in Finland. In C Europe mainly hunted in spring.

Bibliography. Naito *et al.* (1991, 1992), Angelstam (1983, 1984, 1985), Angelstam *et al.* (1985), Barnes (1991), Bernard (1979, 1981, 1982a), Bernard-Laurent (1983), Bille (1969), Blaser (1965), Boback & Müller-Schwarze (1968), Bocca (1987), Borsari & Krafft (1973), Brittas & Willebrand (1991), Brull (1961, 1971), Cayford & Walker (1991), Cheng (1989), Chinnery & Couturier (1980b), Cramp & Simmons (1980), Degen (1979), Dienecke & Niehmmer (1970), Ellison & Magnani (1985), Ellison, Leonard & Menoni (1988), Ellison, Magnani & Cori (1981), Etchecopar & Hue (1978), Flint *et al.* (1984), de Franceschi (1978, 1981, 1986, 1988), Glutz von Blotzheim

(1981), Grote (1943), Grove *et al.* (1988), Gwinner-Hanke (1991), Haker & Myrberget (1969), Hanson & Soikkeli (1984), Helminen (1963), Helminen & Viramo (1962), Hjorth (1968), Höglund *et al.* (1992), Isenmann *et al.* (1970), Joensen (1967), Johnstone (1969), Jurlov (1960), Kustdalen (1986), Kustdalen & Wegge (1985), Keller *et al.* (1979), Klaus *et al.* (1990, 1991), Koivisto (1965), Koivisto & Pirkola (1961), Kolstad & Wegge (1985), Koskimies (1957), Krujij & Hogan (1967), Kuz'mina (1992), Lack (1939), Lindén (1981a, 1981b, 1984a), Marjakangas (1986, 1990), Marjakangas & Aspegren (1991), Marjakangas *et al.* (1984), Marti (1979, 1986), Marti & Pauli (1985), Mees (1970-1972), Miquet (1990), Niewold (1982), Niewold & Nijland (1987), Nikul'cev (1967), Pauli (1974, 1979), Ponce (1984), Porkert (1969a, 1980), Pré (1981), Pulliainen (1982b), Rajala (1974), Renard (1988), Renard & Schmitz (1988), Rintamäki *et al.* (1983), Robel (1969a, 1969b), Rodionov (1966), Rogacheva (1992), Seiskari (1962), Simeonov *et al.* (1990), Stegmann (1932), Storaas & Wegge (1985, 1987), Streule (1973), Tyagunas (1984), Ul'janin (1949), Vos (1979, 1983), Wegge & Storaas (1990), Westerskov (1943), Willebrand (1982, 1988, 1992), Zhinden (1980), Zetel (1974), Zverev (1962).

8. Caucasian Black Grouse

Tetrao mlokosiewiczii

French: Tétrás du Caucase

German: Kaukasusbirkhuhn

Spanish: Gallo-lira Caucasiano

Taxonomy. *Tetrao mlokosiewiczii* Taczanowski, 1875, Lagodekhi, eastern Caucasus.

Often placed in genus *Lyrurus* alongside *T. tetrix*, with which forms superspecies. Monotypic.

Distribution. Great and Little Caucasus Mts, S into NE Turkey and NW Iran.



Descriptive notes. 38-53 cm, with female smaller; male 820-1005 g, female 750-784 g. Very similar to *T. tetrix*, but plumage greener black; lacks white on wingbar and undertail-coverts; long tail has shorter "lyres", which partly curve downwards. Female grey-brown, narrowly barred black; tail almost square-ended. First-winter bird and juvenile very similar to female.

Habitat. Typically in transition between upper limits of mountain forests (*Picea orientalis*, *Betula*) and subalpine meadows with rhododendron (*Rhododendron caucasicum*) thickets and stunted birch; after chicks hatch,

brood can move onto alpine meadows. In NW Caucasus, most birds live within vertical range of 300-500 m, centred on the tree-line. In summer, mainly found in subalpine meadows, while during winter tends to concentrate in upper parts of forests; on Great Caucasus in Azerbaijan, occurs at 1700-3300 m, especially at c. 2400 m, but in winter descends to 800-1000 m.

Food and Feeding. In winter, mainly buds and catkins of birch (*Betula*), and fruits and needles of juniper (*Juniperus*); also dog-rose (*Rosa*) fruits, rhododendron leaves, spruce (*Picea*) needles and leaves of *Vaccinium*. During summer, mainly pods, stalks, flowers, berries and seeds of alpine plants, including *Daphne*, *Vaccinium* and *Fraxinus*. Insects rarely taken by adults; during first 10-15 days, chicks eat almost exclusively insects, mainly beetles, later moving onto berries. In autumn, as birds descend into forest, they take spruce needles, crab-apple leaves and acorns. Main foraging periods, at least during winter, are shortly after daybreak and in evening.

Breeding. Laying in May. Nest is a shallow scrape, lined with grass and feathers, concealed in bushes (e.g. rhododendron, juniper) or sometimes under a rock. Normally 6 eggs (2-10); incubation 20-25 days; downy chick almost identical to that of *T. tetrix*, perhaps paler and with cap less distinctly bordered with black; chick apparently able to fly at 10-14 days. Success: of 80 eggs, 60 hatched; in Jul, average brood size 3-7. Sexual maturity in first year, but males probably do not mate until at least second.

Movements. Only limited altitudinal movements of up to 2 km recorded.

Status and Conservation. INSUFFICIENTLY KNOWN. Included in USSR Red Data Book and protected by hunting regulations in most places. In late 1970's, was still reasonably numerous in suitable areas, but has now disappeared from some mountains at N and S limits of range. In Azerbaijan, total population reckoned to be 1500-2000 birds; declining outside protected areas, due to intensive grazing of subalpine meadows, and predation of young by sheepdogs; fairly intense hunting pressure, especially in Little Caucasus. In Zakataly Reserve, NW Azerbaijan, recent censuses gave 252 birds in 1982, 257 in 1988, 136 in 1989 and 221 in 1990; only c. 30% of these were females, so total population probably somewhat higher; density of 20 birds/3-5 km route. Recent survey of Kackar Mts in NE Turkey yielded 134 males at 6 sites; at least 50 males seen displaying at Sivrikaya. Monitoring of populations required.

Bibliography. Averin (1938), Belik (1986b), Bergmann *et al.* (1991), Cramp & Simmons (1980), Dementiev & Gladkov (1952), Flint *et al.* (1984), Hue & Etchecopar (1970), Kinkov (1975), Klaus *et al.* (1988, 1990), Kutubidze (1961), Kuz'mina (1992), Patrikeev (1993), Potapov (1978, 1982b, 1985), Potapov & Flint (1989), Potapov & Pavlova (1977), Scott (1976), Temple & Cocker (1991), Tkachenko (1966), Vitovic (1986).

9. Western Capercaillie

Tetrao urogallus

French: Grand Tétrás

German: Auerhuhn

Spanish: Urogallo Común

Taxonomy. *Tetrao Urogallus* Linnaeus, 1758, Sweden.

Forms superspecies with *T. parvirostris*, with which very commonly hybridizes where ranges overlap in Siberia (up to 12% of males reported to be hybrids in one area); hybrids also common with *T. tetrix* and occasional with *Lagopus lagopus*. Many of proposed races clearly intergrade, and sometimes reduced essentially to two, with nominate in N and *taczanowskii* in S, but this option probably oversimplistic. Twelve subspecies currently recognized.

Subspecies and Distribution.

T. u. cantabricus Castroviejo, 1967 - Cantabrian Mts (NW Spain).

T. u. aquitanicus Ingram, 1915 - Pyrenees.

T. u. major C. L. Brehm, 1831 - C Europe, from Germany and Alps to SW Baltic states, W Byelorussia, E Carpathians and N Macedonia.

T. u. rufifrons Dobrowski, 1912 - Carpathians in Ukraine and Romania, and Rhodope Mts in Bulgaria.

T. u. urogallus Linnaeus, 1758 - Scandinavia; Scotland (where reintroduced).

T. u. lonnbergi Snigirevski, 1957 - Kola Peninsula.

T. u. karelicus Lönnberg, 1924 - Finland and Russian Karelia.

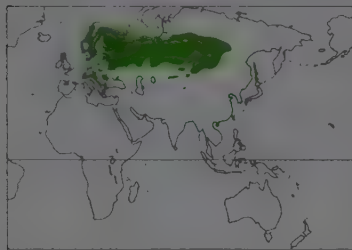
T. u. pleskei Stegmann, 1926 - Byelorussia, N Ukraine and most of European Russia.

T. u. obsoletus Snigirevski, 1937 - from L Onega through N Russia and N Siberia to upper R Lena.

T. u. volgensis Buturlin, 1907 - C & SE Russia.

T. u. uralensis Menzbier, 1887 - S Urals and SW Siberia E to Barnaul.

T. u. tuzanowskii Stejneger, 1885 - C Siberia, S to Altai Mts and NW Mongolia.



dusky bill; in both sexes first-winter bird has outer two primaries speckled reddish brown. Juvenile shows pale shaft streaks on mantle. Races separated mainly on darkness of plumage and size.

Habitat. Forest and woodland, mainly coniferous (especially *Pinus sylvestris*, but also *Picea*, *Abies*, etc.) or mixed coniferous-deciduous; also isolated broad-leaved forests in parts of range, e.g. Cantabrian Mts (N Spain) and S Urals. Prefers extensive areas of old, shady forest, often with damp soil and interspersed with bogs, areas of peat or glades, and with a dense undergrowth of ericaceous plants (*Vaccinium*, *Calluna*). In winter, may select more open forest, at least in N, while during summer denser forest with abundant fruit bushes are preferred, especially by broods and moulting birds.

Food and Feeding. During winter mainly pine needles, constituting up to 100% in Finland, mostly *P. sylvestris*, but also *P. cembra*, *P. uncinata*, etc. Tree-feeding in winter can last for 5 months in N, until absence of snow allows feeding on ground. In S, winter diet more varied, e.g. in Cantabrian Mts, holly (*Ilex aquifolium*) leaves and birch (*Betula*) buds during snowy periods, but otherwise buds of blueberry/bilberry (*Vaccinium myrtillus*) and heaths (*Erica*). Inter-seasonal and summer food includes needles, leaves, stems and berries of a variety of plants, including juniper (*Juniperus communis*), blueberry, whortleberry (*Vaccinium uliginosum*), crowberry (*Empetrum nigrum*), cloud-berry (*Rubus chamaemorus*), cow-wheat (*Melampyrum pratense*), woodrush (*Luzula*), sedges (*Carex*), horsetails (*Equisetum*), mosses, etc. Insects are important only for small chicks.

Breeding. Laying mainly in May (mid-Apr to mid-Jun). Promiscuous; males form ill-defined leks. Nest is shallow depression, scantily lined with grass, pine needles, twigs or some feathers, in thick cover, often at base of tree. Normally 6-9 eggs (4-12); incubation c. 26 days; downy chick lacks brown on crown and has characteristic black V-mark on forehead; flight-feathers and upperwing-coverts start to develop at hatching, and chick able to fly at 2-3 weeks; first primary shed at 17 days. Clutches that hatch, 84-94% for different years in Finland, where other study revealed 60% of eggs laid produced chicks that were still living in late Aug. Sexual maturity in first year, but males do not mate before three. Annual survival rate c. 60% in adult males; one survived to 13-5 years old; in captivity may live up to 18 years or more.

Movements. Mainly sedentary, but often with local movements in winter in response to feeding requirements, e.g. in Siberia, regularly moves from deciduous to coniferous woodland for winter. Females tend to move farther than males. Also some irregular movements, on occasion of over 1000 km, which may be eruptive; wandering birds even enter villages, where recorded crashing into buildings.

Status and Conservation. Not globally threatened. Still occupies most of original range, although serious declines in W Europe have led to extinctions in Ireland, Great Britain, Belgium, most of France and Germany, Hungary and many other areas; now mainly confined to mountains and N areas. Race *cantabricus* of Cantabrian Mts considered endangered in Red Data Book of 1978/79; c. 600 males in 1980. In Pyrenees, c. 2500 birds estimated in Spain, and c. 5000 in France; in Alps, c. 250 males in France, c. 1100 males in Switzerland, 6500-9000 birds in Italy, and c. 10,000 males in Austria; perhaps under 2200 males in Germany. In Scotland, where extinct from 1785, successfully reintroduced around 1837 and presently numbers c. 1000-2000 birds, but declining. Also declining, though generally more secure, in Fennoscandia, where during 1960's estimated 300,000-400,000 males in Norway and 600,000 in Finland. In Ukraine, occurs in Poles'ye zone and Carpathians, where was common and fairly numerous at turn of century; has declined rapidly since 1960's, due to deforestation, amelioration of climate, pesticides, disturbance and poaching; total population now reckoned to number 4400-5300 birds; protected in 3 nature reserves and suffers no hunting pressure. Many estimates of densities available, ranging from 0.1 males/km² in primeval forest of Bialowieza (NE Poland) to 24 birds/km² in natural pine forests in Scotland, but most typically c. 0.5-1.0 males/km². Still commonly hunted, except in SW Europe, with annual bags: in Sweden c. 16,000 birds in 1978-1980; in Norway c. 13,000 in 1980, but c. 40,000 around 1960; and in Finland 14,500-33,000 in 1969-1976, but up to 104,000 during early 1960's. Main threat is destruction or alteration of woodland. Afforestation has locally fostered some recoveries, but modern forestry practices generally detrimental. Other factors possibly involved in declines include excessive shooting, disturbance, pollution (acid rain) and perhaps climatic changes.

Bibliography. Alamy and de Juan (1983), Almasan (1970), Andreev & Lindén (1986), Badlati (1992), Beshkarev (1990), Bonet & Kraft (1973), Borschevskij (1988, 1990), Castroviejo (1967, 1975), Castroviejo *et al.* (1974), Catusse (1988, 1992), Chappatte *et al.* (1991), Cheng Tso-hin (1979a), Couturier & Couturier (1980a), Cramp & Simmons (1980), Danilov (1965), Devau & Catusse (1987), Dzioculowski & Matuszewski (1982), Fernández *et al.* (1991), Flint *et al.* (1984), de Franceschi (1986, 1988), de Franceschi & Bottazzo (1991), Gjerde (1984, 1990, 1991b), Gjerde & Wegge (1989), Gjerde *et al.* (1985), Grote (1943), Helminen (1963), Helminen & Virmo (1962), Hissa *et al.* (1990), Hjorth (1977, 1982), Höglund (1955), Höglund & Porkert (1992), Hölzinger & Rosler (1990), Ivantsev (1965, 1974), Jacob (1987), Kivildalen (1986), Kivildalen & Wegge (1985, 1988), Kirpichev (1972), Klaus *et al.* (1968, 1985, 1989), Korch (1978), Koivisto & Pirkola (1981), Koskimies (1957), Krot (1966), Kuz'mina (1992), Larson *et al.* (1982), Leeleer (1987, 1988a, 1988b), Lennerseth (1966), Lindén (1981a, 1981b, 1981c, 1984a, 1984b, 1989a), Lindroth & Lundgren (1950), Lumsden (1961b), Marström (1960), Marjakangas *et al.* (1984), Menoni (1987), Menoni & Novoa (1988), Mittermeier (1989), Molmer & Loeck (1981), Moss (1986, 1988), Moss & Loeck (1979), Moss & Oswald (1985), Moss & West (1987), Müller (1979), Ostrovskij (1973a, 1973b), Picotzi *et al.* (1992), Porkert (1990), Potapov (1989), Pulliam (1990), Pulliam *et al.* (1989, 1992), Pulliam & Janskan (1991), Rajala (1974), Rogacheva (1992), Roisud (1988, 1989), Roisud & Wegge (1987, 1988, 1989a, 1989b, 1989c, 1989d), Roisud *et al.* (1988, 1991), Roisud *et al.* (1990), Roisud (1992), Roisud & Wegge (1987, 1988, 1989a, 1989b, 1989c, 1989d), Roisud & Gausas (1992), Späth (1992), Späth & Sten (1988, 1991), Späth *et al.* (1985), Stein (1974), Storani & Wegge (1985, 1987), Storch (1991), Storch (1992), Storch & Späth (1988, 1991), Storch *et al.* (1981), Villanne (1966), Vint (1991), Wegge (1980, 1985), Wegge & Larsen (1987), Wegge & Storani (1990), Wegge *et al.* (1986), Zwickel (1986).

10. Black-billed Capercaillie

Tetrao parvirostris

French: Tétras à bec noir

German: Steinadlerhuhn

Spanish: Urogallo Piquin Negro

Other common names: Siberian/Small-billed Stone-bird/Rock Capercaillie

Taxonomy. *Tetrao parvirostris* Bonaparte, 1856, Muka-Sanaga, west of Aldan and Amginskoje, east Siberia.

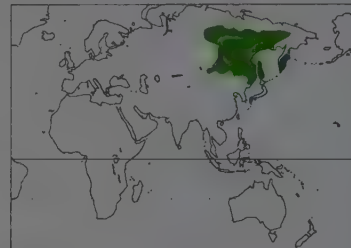
Synonym *T. urogalloides*. Forms superspecies with *T. urogallus*, with which frequently hybridizes in the limited areas of overlap in basin of R Yenisey. Birds from various parts of Siberia formerly awarded races *tarensis*, *janensis* and *kolymensis*, and those from Transbaikalia race *macrurus*. Three subspecies currently recognized.

Subspecies and Distribution.

T. p. parvirostris Bonaparte, 1856 - E Siberia, from lower R Yenisey to the upper R Anadyr, S to Transbaikalia, Manchuria, Ussurieland and Sikhote-Alin Mts; Sakhalin I.

T. p. kamshaticus Kittlitz, 1858 - Kamchatka.

T. p. stegmanni Potapov, 1985 - L Baikal area, Sajon Mts and N Mongolia, from Khangai Mts to Kentei Mts.



Descriptive notes. 68-97 cm, female much smaller; male 3350-4580 g, female 1700-2200 g. Similar to *T. urogallus*; blackish, with underparts predominantly black, but white tips to secondaries and conspicuous white marks on scapulars, greater wing-coverts and uppertail-coverts. Bill black; red combs relatively small. Female like that of *T. urogallus*, but darker, more heavily marked on upper breast, and with larger white marks on wing coverts and secondaries. Races differ mainly in extent of white on upperwing and flanks.

Habitat. Distribution related to larch (*Larix gmelini*) taiga forest, both in plains and

mountains, extending from wooded tundra in N to woody steppes in S Transbaikalia. In some regions also in pine, cedar or mixed deciduous-coniferous forests. In parts of Kamchatka, found in park-like birch stands, primarily of *Betula ermani*. Apparently, in general adapted to more open environments than *T. urogallus*.

Food and Feeding. Limited information available. Probably has more adaptable winter diet than *T. urogallus*, largely relying on larch buds and shoots, but also taking pine and fir needles, birch catkins and buds, fruits of wild roses and other items. From spring to autumn eats berries and leaves of *Vaccinium*, *Empetrum nigrum*, *Juniperus*, etc.; also some invertebrates, e.g. caterpillars, midges, ant eggs.

Breeding. Laying May-Jun. Promiscuous; males form ill-defined leks. Nest is small depression, lined with needles, moss, grass and some feathers, often below drooping branches of fir, fallen logs or branches, or under crown of a fallen tree. Lays 6-7 eggs (5-10); incubation c. 24 days; downy young similar to those of *T. urogallus*, but with rufous crown patch, and more rufous, less streaked back; capable of flight at c. 10 days.

Movements. Probably sedentary, although very little information available. Altitudinal movements reported from Kamchatka, where females winter at higher elevations.

Status and Conservation. Not globally threatened. Formerly very common and much hunted, especially in S areas. However, populations have decreased, perhaps partly as result of natural fluctuations. Establishment and enforcement of hunting regulations needed.

Bibliography. Andreev (1975a, 1977a, 1979, 1991a), Dementiev & Gladkov (1952), Etchecopar & Hül (1978), Flint *et al.* (1984), Gao *et al.* (1988), Johnsgard (1983a), Kirikov (1975), Kirikov & Shubnikova (1968), Klaus *et al.* (1989), Kuz'mina (1992), Larionov (1962), Lobko-Lobanovskij & Zilin (1962), Porkert (1992), Potapov (1985), Potapov & Flint (1989), Rogacheva (1992).

Genus BONASA Stephens, 1819

11. Hazel Grouse

Bonasa bonasia

French: Gelinotte des bois

German: Haselhuhn

Spanish: Grévol Común

Other common names: Hazel Hen

Taxonomy. *Tetrao bonasia* Linnaeus, 1758, Sweden.

Formerly placed in genus *Tetrastes*. Forms superspecies with *B. sewerzowi*. Occasional hybridization reported with *Lagopus lagopus*, *L. mutus* and *Tetrao tetrix*. Complex internal taxonomy, with various attempts to lump races, e.g. only four recognized: with *styriaca*, *rhenana* and *schiebeli* placed in *rupestris*; *volgensis* and *griseonota* in *bonasia*; *kolymensis* in *sibirica*; *amurensis* and *yamashinai* in *vicinitas*. Twelve subspecies currently recognized.

Subspecies and Distribution.

B. b. styriaca (von Jordans & Schiebel, 1944) - Jura Mts, Alps, Hungary, Slovakia and S Poland.

B. b. rhenana (Kleinschmidt, 1917) - NE France, Luxembourg, Belgium and W Germany.

B. b. rupestris (C. L. Brehm, 1831) - S Germany, Bohemia and Sudety Mts.

B. b. schiebeli (Kleinschmidt, 1943) - Balkan Peninsula.

B. b. volgensis (Buturlin, 1916) - Poland and Ukraine to C European Russia.

B. b. bonasia (Linnaeus, 1758) - S Scandinavia, Finland and N European Russia to Urals.

B. b. griseonota Salomonsen, 1947 - N Sweden.

B. b. sibirica (Buturlin, 1916) - most of forested Siberia S to Altai and Sajon Mts, N Mongolia and N Amurland.

B. b. kolymensis (Buturlin, 1916) - extreme E Siberia, from N Yakutia and Verkhoyansk Mts to Sea of Okhotsk.

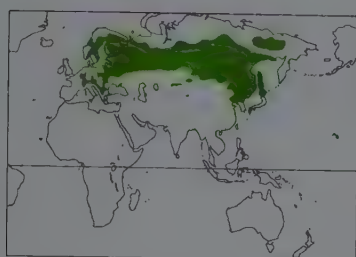
B. b. amurensis (Riley, 1916) - S Amurland and Little Khingan Mts S to N Korea.

B. b. yamashinai (Moriyama, 1928) - Sakhalin I.

B. b. vicinitas (Riley, 1915) - Hokkaido (N Japan).

Descriptive notes. 35-40 cm; 370-430 g; female only slightly smaller. Variably brownish grey, with fine dark barring on crown, neck, mantle and uppertail-coverts, underparts barred or spotted with dark grey and ochre; chin black, bordered with white; white lines below and behind eyes and on sides of neck; tail relatively long and rounded, white fringed, with a black subterminal band, broken by brown central pair of rectrices. Small erectile crest; small red combs; greyish black bill. Female brownish, with whitish throat. First-winter bird almost identical to adult, with some minor differences in two outermost primaries; juvenile like adult female, with white shaft streaks on back. Races differ mainly in size and intensity of grey and brown tones.

Habitat. Mostly mixed coniferous-deciduous woodland, both in plains and in mountains, up to 1600-1800 m in Alps. Habitat varies in different parts of extensive range, but species seems to avoid pure coniferous stands, and does occur in areas without conifers, e.g. parts of W Europe and mountainous regions of N Mongolia and Transbaikalia. Large, dense forests with rich, varied undergrowth and occasional clearings are generally preferred, as are presence of thickets of alder



(*Alnus*), birch (*Betula*), aspen (*Populus*), hazel (*Corylus*) and other "catkin" trees; along streams and rivers, in transitional areas or in clearings caused by fires, avalanches or lumbering.

Food and Feeding. During winter almost exclusively catkins, buds and twigs of alder, birch or both; also hazel, aspen, etc. In spring, these are gradually replaced by leaves of same trees, and, depending on snow conditions, leaves and flowers of ground vegetation. Berries and other fruits important during summer and autumn, mainly those of *Vaccinium*, but also *Ribes*, *Fragaria*, *Rubus*, *Sorbus*, *Crataegus*, *Prunus* and others, varying considerably from region to region depending on availability. Chickens eat almost exclusively arthropods during first 10 days, mainly ants and their larvae, but also beetles, caterpillars, grasshoppers and spiders; thereafter, progressively more vegetarian. In autumn, nuts, acorns and seeds can be of importance, e.g. *Carpinus*, *Acer*, *Quercus*, *Fagus*, conifers, etc. Daily food c. 41 g in winter, 58 g in spring, 28 g in summer, and 27 g in autumn.

Breeding. Laying Apr-May in C Europe. May-Jun in Scandinavia and Siberia. Monogamous; male usually leaves territory during incubation. Nest is a shallow scrape, lined with grass, leaves and other plant material, well concealed by undergrowth or under roots of fallen tree. Lays 7-11 eggs (5-14); incubation c. 25 days; downy young have brown crown cap not bordered by black; flight-feathers present at or shortly after hatching; chicks capable of flight at c. 15 days. Average brood size (when still dependent) 4-7 in one study. First breeding at one year old. Annual adult survival rate probably c. 30%; one ringed bird survived 7 years, 3 months.

Movements. Highly sedentary: in Russia, 88% of recoveries within 500 m of ringing site, maximum 1500 m; average of 20 recoveries in Sweden and Finland, 1-2 km, maximum 10 km. Females and juveniles tend to disperse farther.

Status and Conservation. Not globally threatened. Marked declines and some range contraction in many parts of W & C Europe, e.g. extinctions in Pyrenees, Massif Central and some lowland areas of Germany. Populations of under 10,000 pairs in France, 5000-6000 in Italy, c. 200 in Belgium, c. 30,000 in Estonia, c. 150,000 in Sweden, and c. 230,000 in Finland; generally much more numerous eastwards, but very rare in Ukraine, where occurs only in Poles'ye zone and Carpathians, with highest density of 2 pairs/km². Abundance varies markedly between years. Spring densities in Switzerland range from c. 2 pairs/km² in lowlands to over 5 pairs/km² in forests above 1000 m; up to 30 birds/ha in a mixed forest area of Poland. Autumn densities in N European mixed forests usually average 4-6-37 birds/km²; in C European montane forests 10-11 birds/km². Hunting not likely to affect populations, given secretive habits of species; some annual bag figures during 1970's include c. 10,200 birds in Norway, c. 18,000 in Sweden and 28,000-69,600 in Finland, but more intensively hunted in European Russia and Siberia. Apparently very sensitive to habitat changes, especially modern forestry trends, although small-scale timber work could have positive effects.

Bibliography. Ahnlund & Helander (1975), Andreev (1977b), Andreev & Krehmar (1976), Aschenbrenner *et al.* (1978), Aubin (1970, 1972), Bauer (1960), Bergmann *et al.* (1975, 1982), Bonczar & Swenson (1992), Bonczar & Wrobel (1991), Brazil (1991), Catusse *et al.* (1992), Cramp & Simmons (1980), Donaurov (1947), Eichéopar & Hue (1978), Flint *et al.* (1984), de Franceschi (1986, 1988), Gajdar (1974a, 1974b), Gavrin (1969), Heim de Balsac (1935), Ivanter (1962, 1963), Jacob (1987), Koch (1978), Krätzig (1939), Kuz'mina (1992), Leclercq (1988b), Ledant (1990), Linden (1981b), Potapov & Flint (1989), Pynnönen (1954), Rodionov (1963), Rogacheva (1992), Romanov (1963), Salo (1971), Schatt (1991a, 1991b, 1993), Scherzinger (1981), Simeonov *et al.* (1990), Stenman & Helminen (1974), Swenson (1991a, 1991b, 1991c, 1992, 1993), Swenson & Andreev (1991), Swenson & Boag (1993), Swenson & Danielson (1991), Swenson & Olsson (1991), Teidoff (1951), Tomek (1965), Uusvaara (1963), Wiesner *et al.* (1977), Wilowski (1968), Zbinden (1979).

12. Severtsov's Grouse

Bonasa sewerzowi

French: Gélinotte de Severtzov **German:** Schwarzbrust-Haselhuhn **Spanish:** Grévol Chino
Other common names: Severtsov's Black-breasted Hazel Grouse

Taxonomy. *Tetrastes sewerzowi* Przevalski, 1876, mountains of Gansu, central China. Closely related to *B. bonasia*, with which forms superspecies. In past, birds of S and W often awarded separate race, *secunda*. Monotypic.

Distribution. Mountains of C China, from C Gansu and S Qinghai to E Tibet, NW Yunnan and N Sichuan.



Descriptive notes. 34 cm, c. 270 g. Very similar to *B. bonasia*; upperparts more broadly barred black and upper breast more chestnut, with only small white tips to feathers; tail has quite different barred pattern.

Habitat. Birch and coniferous mountain forests, generally above 1000 m, and as high as 4000 m in Tibet; the altitude occupied increases with decreasing latitude, e.g. breeds at 2350-3000 m in Qilian Mts of NW Gansu, but at 3530-3820 m in NW Yunnan. In places, may reach tree-line and during summer even alpine belt, in areas of rhododendron. In Gansu, main habitats types centred on dragon

spruce (*Picea crossata*), sometimes with 60-90% cover of moss (*Vaccinella*, *Braun*) on forest floor; other typical plants include birch (*Betula*), willow (*Salix*) and barberry (*Berberis*); grassland and alpine shrubs generally avoided.

Food and Feeding. In Gansu, mainly flower and leaf buds of willow and birch in early spring, moving onto flower buds and leaves of the same species by May, in Jun-Jul, seeds and inflorescences of *Polypodium* dominate. Forages on ground or in trees.

Breeding. Laying from end May to Jun. Monogamous. Nest at base of tree, in tree stump or on rocky ledge; made of grass, sometimes lined with pine needles and partly edged with moss. Lays 5-8 eggs; incubation 25 days (artificial); downy chicks have head markings more apparent than in other *Bonasa*.

Movements. Apparently sedentary.

Status and Conservation. Not globally threatened. Very little information available. Common in suitable forest; has disappeared from E Qinghai and C Gansu, due to deforestation, and also suffering intensive habitat loss in SW Gansu. Simultaneous preparation of eggs by Large-rumped Crows (*Corvus macrorhynchos*), accounting for failure of 50% of nests located during recent study.

Bibliography. Beick (1927), Cheng Tso-hin (1987), Eichéopar & Hue (1978), Johnsgard (1983a), Liu & Gong (1994), Meyer de Schauensee (1984), Ræthel (1988), Schonwetter (1929), Short (1967), Stressemann *et al.* (1938).

13. Ruffed Grouse

Bonasa umbellus

French: Gélinotte huppée

German: Kragenhuhn

Spanish: Grévol Engolado

Taxonomy. *Tetrao umbellus* Linnaeus, 1766, Pennsylvania.

Only know to have hybridized, very rarely, with *Falcipecten canadensis*. Fourteen subspecies currently recognized.

Subspecies and Distribution.

B. u. yukonensis Grinnell, 1916 - W Alaska and C Yukon to N Alberta and NW Saskatchewan.
B. u. umbelloides (Douglas, 1829) - N British Columbia through C Alberta, C Saskatchewan, Manitoba and Ontario to Quebec.

B. u. labradorensis Quellet, 1990 - Labrador Peninsula.

B. u. sabini (Douglas, 1829) - Pacific coast from SW British Columbia to NW California

B. u. brunneus Conover, 1935 - Vancouver I.

B. u. castanea Aldrich & Friedmann, 1943 - Olympic Peninsula.

B. u. affinis Aldrich & Friedmann, 1943 - inland British Columbia S to C Oregon.

B. u. phala Aldrich & Friedmann, 1943 - SE British Columbia to E Oregon and SC Idaho.

B. u. incana Aldrich & Friedmann, 1943 - SE Idaho and W Wyoming S to C Utah.

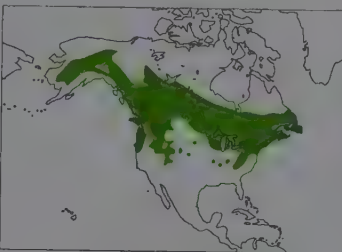
B. u. mediana Todd, 1940 - Minnesota and S Wisconsin.

B. u. togata (Linnaeus, 1766) - S Ontario and S Quebec S to N Wisconsin, C Michigan and C New York.

B. u. thayeri Bangs, 1912 - Nova Scotia.

B. u. umbellus (Linnaeus, 1766) - C New York and C Massachusetts S to E Pennsylvania and New Jersey.

B. u. monticola Todd, 1940 - S Michigan, Ohio and Pennsylvania, through Appalachian Mts to N Georgia.



Descriptive notes. 43-48 cm; male c. 600-650 g, female c. 500-590 g. Relatively large grouse, with short crest, fan-shaped tail with highly distinctive dark subterminal band, and erectile black ruffs on sides of neck. Very cryptic plumage, with two colour morphs, grey and brown, and intermediates; grey morph commoner in N areas, brown in S; small orange-red combs, more developed in spring. Female very similar, but combs not developed, tail shorter and with incomplete dark band, and fewer white spots on rump. Immature retains two outer, more pointed juvenile primaries. Juvenile like adult female, but barred tail lacks subterminal band; more mottling on primaries.

Habitat. High diversity of woodland types in extensive range, from typical boreal forest to Pacific coast rain forest, and relatively dry deciduous forest, but always with some deciduous trees, especially aspens (*Populus tremuloides*, *P. grandidentata*), range of which largely coincides with that of present species. Earlier successional stages generally preferred, as are scattered openings with herbaceous plants, so logging and fires tend to improve habitat quality. A small percentage of coniferous trees can provide valuable cover during winter.

Food and Feeding. During winter, largely buds and twigs of trees, especially in regions of continuous snow cover. Male flower buds of aspens seem to be most important winter resource; other plants taken include *Betula*, *Salix*, *Alnus*, *Corylus*, *Prunus*, *Acer* and *Cornus*, depending on availability. In New England, even turns to apple orchards. After winter, diet diversifies with access to leaves and flowers of ground vegetation, but buds and catkins of trees often remain important. During summer, berries and other fruits (*Fragaria*, *Rubus*, *Prunus*, *Amelanchier*, etc.) become significant, and small quantities of insects also taken. Arthropods are basic food for chicks during first 1-2 weeks, especially ants, also sawflies, ichneumon flies, beetles, spiders, grasshoppers and caterpillars. Autumn food includes variety of fruiting shrubs (*Sorbus*, *Cornus*, *Viburnum*), leaves, acorns, mushrooms and increasing proportions of buds and catkins.

Breeding. Laying mostly in May. Promiscuous; males dispersed. Nest is bowl formed in leaves on forest floor, without lining, usually at base of tree, stump, boulder or large log, in fairly open situation. Lays 10-12 eggs (6-15); incubation 23-24 days; downy young have black on head restricted to little more than two elongated ear patches reaching the eyes; chicks capable of flight at 10-12 days; first primary shed at c. 14 days. In Alberta, 80% of clutches hatched, and 37-51% of chicks survived at least 12 weeks, in Minnesota, 32% of nests were destroyed before hatching and about 40% of chicks survived until mid-Aug. Sexual maturity at one year old. Annual adult survival rate 47% in males; mean longevity after first autumn 1.25 years; maximum known survival in marked birds almost 4 years.

Movements. Highly sedentary. Short range juvenile dispersal in autumn, with females moving farther; in Minnesota, females move 3-4 times more than males, maximum c. 17 km.

Status and Conservation. Not globally threatened. Widespread and fairly common throughout most of original range. Some range contractions in past almost compensated for by successful restocking and even introductions into new areas (e.g. Newfoundland, Nevada). Density varies widely between habitats and especially between years, with fivefold to tenfold fluctuations, roughly in 10 year cycles; up to 50+ breeding birds/km². Extensively hunted; annual bags in late 1970's estimated at c. 6,000,000 birds, but in most areas hunting is probably at sustainable levels. Increasing commercial importance of aspens and some recent forestry management practices seem highly beneficial.

Bibliography. Aldrich & Friedmann (1943), Allen (1931), Archibald (1973, 1974, 1978, 1976, 1976b), Bakke (1980), Barrett (1970), Bevdex (1944), Boag (1976), Boag & Sumanik (1969), Brander (1965, 1967), Brewer (1980), Brown, C.P. (1944), Bunnell *et al.* (1947), Crampton (1970), Davies (1973), Davies & Robinson (1979), Davis & Stoll (1973), Doerr (1973), Doerr *et al.* (1974), Dorney (1963), Ehammer (1947), Eng (1959), Eng & Pulliam (1967), Fischer & Keith (1974), Godfrey (1967, 1975), Godfrey & Marshall (1968), Gorman (1967, 1970, 1977, 1981a, 1981b, 1982, 1984, 1990), Guilford & Marshall (1968), Hale & Dorney (1964), Hale *et al.* (1982), Hoffman & Braun (1988), Huchelme (1981), Huchelme & Jester (1985), Hall *et al.* (1975), Jakson & Gordin (1981), Korschgen (1966), Koskunen (1966), Kubisa (1978), Kupa (1966), Kurzejski & Root (1989), Lawson (1982), Little (1978), Marshall (1946, 1965), Maxson (1974, 1977, 1978), McBurney (1970), McGowan (1973), Medow (1968), Moulton & Vanderschaegen (1974), Nease (1967, 1969), Ouellet (1978), Phillips (1967, 1968, 1970, 1971, 1972), Poran & Vohs (1972), Rasmussen & Brander (1973), Robinson (1984), Roussel & Ouellet (1975), Rusch & Keith (1975), Sato (1978), Samson (1974), Seegal (1967), Short (1967), Short & Short (1970), Short & Short (1978), Sharp (1968), Small & Rusch (1989), Small *et al.* (1991), Stullard & Dunmire (1979), Stauffer (1983), Stauffer & Thompson (1982), Stoll & McClay (1978), Stoll *et al.* (1978), Stoll & Stoll (1978), Stoll & Stoll (1978), Theriault & Gauthier (1982), Thomas *et al.* (1975), Thompson & Fritzell (1988, 1989a, 1989b), Thompson *et al.* (1987), Vanderschaegen (1970), Wenstrom *et al.* (1972), Wiggers *et al.* (1992), Woehr (1974).



Genus *CENTROCERCUS* Swainson, 1832

14. Sage Grouse

Centrocercus urophasianus

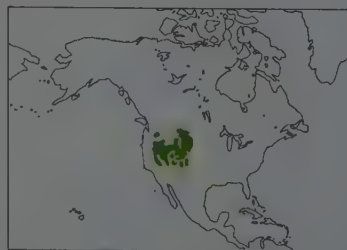
French: Tétrás des armoises German: Beifuhuhn Spanish: Gallo de las Artemisas
Other common names: Sage Hen/Chicken

Taxonomy. *Tetrao urophasianus* Bonaparte, 1827, "North-western countries beyond the Mississippi especially on the Missouri"

Known to have hybridized occasionally with *Tympanuchus phasianellus*, and once with *Dendragapus obscurus*. Populations of NW, from Washington to Oregon, sometimes awarded separate race, *phaios*. Monotypic.

Distribution. W North America, from C Washington, SE Alberta, SW Saskatchewan and SW North Dakota, S to E California, Nevada, Utah and W Colorado. Formerly also in extreme S British Columbia, N New Mexico and extreme NW Arizona.

Descriptive notes. Male 60-70 cm, female 48-58 cm, male c. 2300-3200 g, female c. 1350-1750 g. Greyish brown variegated plumage, with distinctive black belly and long, stiff, pointed tail feathers. Male considerably larger, has black in throat and upper neck, separated by V-shaped white line; large white ruff on breast, large greenish cervical sacs, and relatively inconspicuous yellow eyecombs; white underwing-coverts. Immature like adult female, but paler, with outer primaries more pointed and mottled. Juvenile shows shaft streaks on upperparts and tail feathers.



Habitat. More or less arid grassland with sagebrush (*Artemisia*, mainly *A. tridentata*), in foothills and plains. Winter distribution and relative abundance conditioned by availability of sagebrush above snow. Display grounds tend to be in relatively open cover. Most nests are placed under sage plants, taller ones being preferred. Young broods occur in areas with lower plant density and crown cover.

Food and Feeding. Sagebrush constitutes 62-77% of adult diet overall in year, and almost 100% in winter. Herbaceous legumes and weeds (*Taraxacum*, *Tragopogon*, *Trifolium*, *Astragalus*, *Lactuca*, etc.) also important.

mainly during summer and for juveniles. In some areas species feeds on cultivated legumes, e.g. alfalfa and clover. Adults take small amounts of insects (in one study 9% in summer, 2% both in spring and in autumn); during early life, chicks rely on ants, beetles, weevils and grasshoppers, which represent up to 75% of food during 1st week.

Breeding. Laying mostly Apr-May. Promiscuous; males form leks. Nest is shallow depression, usually poorly lined with grass and sage leaves, sometimes without any lining at all, usually under sagebrush plants 25-50 cm tall. Lays 7-8 eggs (up to 15); incubation 25-27 days; downy young have characteristic mottled combination of black, brown, buff and white, but no striping; fly at 1-2 weeks; first primary shed at 24 days. Clutches that hatch, 24-60% in different studies, apparently not many replacement clutches laid; average brood size changed in one study from 5-6 in Jun to 2-3 by Aug. Sexual maturity at 1 year, but probably few males mate until at least 2. Annual adult survival rate 48% in males, 40% in females; one female recovered at 8 years old.

Movements. Mostly sedentary, but in mountainous areas altitudinal movements take place between winter and spring-summer grounds; in Idaho covering up to 80-160 km. Autumn movements gradual, probably depending on snow conditions. Adult males arrive first at display areas, as soon as snow melts. Limited amount of daily movement.

Status and Conservation. Not globally threatened. Still found in most of original range, although some peripheral shrinking has resulted in extinctions in British Columbia and New Mexico, and locally in California. Population levels apparently lower during 1940's. In 1952 total population estimated at c. 150,000 birds, spread over c. 54,000 km² of preferred habitat. During late 1970's, annual hunting bags totalled c. 280,000 birds, including 94,000 in Wyoming, 93,000 in Idaho, 66,000 in Montana, 28,000 in Utah, 18,000 in Nevada, and 12,000 in Colorado; levels apparently not excessive in general. Major threats, given specialized needs for sage plains, are continuous extension of irrigated farmland and elimination of sagebrush by mechanical or chemical means to improve grazing conditions.

Bibliography. Autenrieth (1969, 1981), Autenrieth *et al.* (1982), Barber (1991), Beck (1975, 1977), Beck & Braun (1978), Berry & Eng (1985), Blake (1970), Blus *et al.* (1989), Boyce (1990), Boyce & Tate (1979), Braun *et al.* (1977), Carr (1967), Connelly (1982, 1983), Connelly *et al.* (1988, 1991), Crawford & Lutz (1985), Dalke *et al.* (1960, 1963), Dunn & Braun (1985, 1986), Ellis, K.L. *et al.* (1989), Emmons (1980), Emmons & Braun (1984), Eng (1963), Eng & Schladweiler (1972), Gate (1985), Gibson (1990, 1992), Gibson & Bachmen (1992), Gibson & Bradbury (1986), Gibson *et al.* (1991), Gill (1965), Hartzler (1972, 1974), Hartzler & Jenni (1988), Hupp & Braun (1989a, 1989b, 1991), Johnson & Boyce (1990), Klebenow (1968, 1969), Klebenow & Gray (1968), Klotz & Lindzey (1989, 1990), Lumsden (1968), Martin (1970), Patterson (1952), Petersen (1980), Peterson (1970), Rasmussen & Griner (1938), Rensel & White (1988), Rich (1985, 1993), Ridgway & Friedmann (1946), Rogers (1964), Schlatterer (1968b), Schneegas (1967), Scott (1942), Spurrier *et al.* (1990), Terres (1980), Vehrencamp *et al.* (1989), Wakkinen *et al.* (1992), Wallestad (1971, 1975), Wallestad & Pyrah (1974), Wallestad & Schladweiler (1974), Welch *et al.* (1988), Wiley (1973, 1978).

Genus *TYMPANUCHUS* Gloger, 1842

15. Sharp-tailed Grouse

Tympanuchus phasianellus

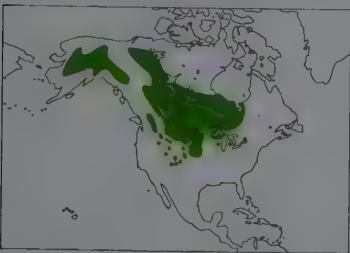
French: Tétrás à queue fine **German:** Schweifhuhn **Spanish:** Gallo de las Praderas Rabudo

Taxonomy. *Tetrao Phasianellus* Linnaeus, 1758, Canada = Hudson Bay. Formerly placed in genus *Pedioecetes*. Hybridizes extensively with *Tympanuchus cupido* where ranges overlap, with both hybrids and backcrosses apparently fertile; hybrids can constitute 0.3-1.2% of combined population in Nebraska, and up to 5-25% on Manitoulin I, Ontario, where contact of these species is recent. Six subspecies currently recognized.

Subspecies and Distribution.

T. p. caurus (Friedmann, 1943) - Alaska to S Yukon, N British Columbia and N Alberta.
T. p. kennicottii (Suckley, 1861) - Mackenzie.
T. p. phasianellus (Linnaeus, 1758) - N Manitoba, N Ontario and WC Quebec.
T. p. campestris (Ridgway, 1884) - S Manitoba and S Ontario to Minnesota, Wisconsin and Michigan; formerly to N Illinois.
T. p. jamei (Lincoln, 1917) - NC Alberta and C Saskatchewan S to Wyoming and Nebraska; formerly to Kansas.
T. p. columbianus (Ord, 1815) - NC British Columbia S to N Utah and W Colorado; formerly to N New Mexico (perhaps *jamei*).

Descriptive notes. 40-48 cm; male c. 950 g, female c. 815 g. Pointed tail characteristic, with central pair of rectrices extending far beyond the others; pure white undertail-coverts; small erectile crest; inconspicuous yellow eyecomb; pinkish to purple cervical sacs. Similar to prairie-chickens, but with paler underparts speckled, not barred. Female and immature very much alike, immature



showing pointed and faded outer two primaries. Juvenile has whitish throat and shorter tail. N birds darker.

Habitat. Wide range of open environments, from grassland and sagebrush semi-desert to relatively dense successional stages of deciduous, mixed or boreal coniferous forests. Preferred amount of tree and bush cover varies with different regions and races; in Wisconsin, most abundant in areas 25-50% covered with wooded vegetation, but in North Dakota minimum of 5% brush cover is tolerable. Availability of food sources, often related to snow depth, important for winter habitat; in some areas presence of trees like birches and aspens may be required. Display grounds usually in rather open, elevated sites, where visibility is good. Brushy or tall grass areas may be important in prairies and plains for resting, nesting and brooding, but in forested areas some form of opening seems essential for feeding. Cultivated fields commonly used for feeding and even for displaying, but apparently not often for nesting.

Food and Feeding. Rather adaptable. During winter, if snow conditions oblige tree-feeding on buds and catkins, primary plant food changes to paper birch (*Betula papyrifera*) in Ontario, Michigan and Wisconsin, to willow (*Salix*) in North Dakota, and to maple (*Acer*) and choke-cherry (*Prunus virginiana*) in Utah. Other genera of plants that are commonly eaten in winter are *Populus*, *Corylus*, *Sorbus*, *Amelanchier*, *Juniperus*, etc. During spring and summer herbaceous plants, including cultivated cereals, clover and alfalfa, make up most of the diet; flowers (*Taraxacum*, *Ranunculus*) also of some importance. Insects (e.g. grasshoppers) may also be important during summer, but apparently less so than in other *Tympanuchus*. Autumn food is most variable and includes grain in cultivated areas (wheat, corn, barley, millet, rye, etc.), as well as seeds, leaves, berries and other fruits.

Breeding. Laying Apr-Jun. Promiscuous; males form leks. Nest is slight depression on ground, lined with grass, leaves and some feathers, usually concealed by tuft of tall grass or under bush, in a variety of sites. Lays c. 12 eggs (5-17); incubation 23-24 days; downy young resembles that

of *T. cupido*, but is purer, paler yellowish, lacking rusty tints; chicks capable of flight at 10 days. Clutches that hatch, 40% and 55% in two different studies; brood size reduced from 8-7 to 4-6 young in another study. First breeding at 1 year old. Annual survival rate 40%; average life span estimated at 1.5 years for females and 1.6 years for males; one ringed bird observed at 7.5 years.

Movements. Largely sedentary, with some movements from grassland areas to woody cover in winter. Before advent of agriculture, with changes in prairie habitat and availability of grain, more marked seasonal movements apparently occurred. In Wisconsin, 81% of recoveries within 3-2 km of ringing place. Females and juveniles disperse more; maximum distance recorded c. 150 km in juvenile female. Limited amount of daily movement.

Status and Conservation. Not globally threatened. Still relatively common and widespread in Canada, but range has contracted considerably in S & W; now extinct in 8 states of USA (California, Oregon, Nevada, New Mexico, Oklahoma, Kansas, Iowa and Illinois); occupies less than 50% of original area in other 9 states. Most threatened race is *columbianus*, now with c. 80% of total population of 60,000-170,000 birds restricted to British Columbia, where considered "of special concern". Total population of *campestris* estimated at 600,000-2,000,000 birds; of *jamei* at 600,000-3,000,000 birds. Commonly hunted, and bags amounted to c. 700,000 birds/year during late 1970's (c. 440,000 in USA, 260,000 in Canada). Main problems derive from habitat change into modern cropland, or, in other areas, into woodland, through forest succession or plantation of conifers. Controlled burning useful in maintaining conditions of lekking grounds.

Bibliography. Amman (1944, 1957, 1963a), Artmann (1970), Bernhoft (1969), Caldwell (1976), Christensen (1970), Evans (1961, 1969), Giesen & Connelly (1993), Gratson (1983, 1988), Hamerstrom (1941, 1963), Hamerstrom & Hamerstrom (1951, 1961), Hart *et al.* (1950), Hillman & Jackson (1973), Johnsgard & Wood (1968), Jones (1966), Kermott (1982), Kermott & Oring (1975), Kirsch *et al.* (1973), Klotz & Lindzey (1989, 1990), Kobriger (1965, 1975, 1980), Kohn (1976), Lumsden (1965), Moyle (1977, 1981), Moyle & Boag (1981), Pepper (1972), Ramharter (1976), Ridgway & Friedmann (1946), Rippen & Boag (1974a, 1974b), Rodgers (1992), Rogers (1969), Schiller (1973), Schmidt (1936), Sisson (1976), Snyder (1935), Sparling (1979, 1983), Swenson (1985), Terres (1980), Thaman (1984).

16. Greater Prairie-chicken

Tympanuchus cupido

French: Tétrás des prairies **German:** Präriehuhn **Spanish:** Gallo de las Praderas Grande
Other common names: Prairie/Pinnated Grouse

Taxonomy. *Tetrao Cupido* Linnaeus, 1758, Virginia.

Often considered conspecific with *T. pallidicinctus*. Hybridizes extensively with *T. phasianellus* in areas of overlap. Nominative *cupido* of E USA, from Massachusetts S to Maryland, extinct since 1932. Two extant subspecies recognized.

Subspecies and Distribution.

T. c. pinnatus (Brewster, 1885) - mainly from Dakotas S to Nebraska, Kansas and Missouri; formerly from C Alberta and SE Ontario S to Arkansas.
T. c. atwateri Bendire, 1893 - coastal areas of Texas and (formerly) SW Louisiana.



Descriptive notes. 41-47 cm; male c. 990 g, female c. 770 g; *atwateri* slightly smaller. Brown and extensively barred, on both upperparts and underparts; blackish tail short and rounded; elongated feathers on sides of neck, "pinnae", c. 70 mm long in *pinnatus*, erected during courtship; golden yellow cervical sacs; yellow to orange eyecombs. Female much alike, but tail barred, "pinnae" shorter (c. 38 mm in *pinnatus*), and cervical sacs and combs considerably smaller and paler. Immature also similar, but two outer primaries pointed. Juvenile shows prominent shaft streaks on scapulars.

Habitat. Originally in native prairies intermixed with oak (*Quercus*) woodlands: race *cupido* in scrub oak (*Q. ilicifolia*) mixed with fire-created grasslands or blueberry (*Vaccinium*) barrens, associated with sandy soils; *atwateri* in sandy coastal plains; *pinnatus* in prairie openings in oak woodlands, in oak savannas, and in oak grassy forests extending into tall grass prairie. Marked changes took place with advent of agriculture, so nowadays main habitat is prairie intermixed with croplands. Areas of native vegetation required for roosting and breeding; for displaying, males select sites with short grass, usually on elevated ground. Most nests are in open, grassy habitats, e.g. ungrazed meadows or hayfields.

Food and Feeding. Transformation of original habitat into croplands brought important changes. Presently, cultivated grains (mainly corn and sorghum, also wheat, rye, oats and barley) are primary winter food in many areas, their importance decreasing with latitude (90% in North Dakota, 10-50% in Oklahoma, 9% in Texas). Acorns (*Quercus*) may have been of major importance in past, especially during snowy periods. Leaves, seeds and buds of a variety of plants are taken throughout year; also insects, mainly grasshoppers, which can amount to 30% during summer and are very important for chicks and juveniles. Species forages mostly in early morning and evening, during winter in two periods of c. 80 minutes each.

Breeding. Laying mid-Apr to early Jun (*pinnatus*); late Mar to early Apr (*atwateri*). Promiscuous; males form leks. Nest is bowl-like scrape, lined with feathers, dry grass, leaves, twigs and similar material, among thick grass cover. Lays 8-13 eggs (5-17); incubation 23-25 days; downy young have three black spots on top of head and one on forehead, and irregular small black marks over upperparts; some primaries already present at hatching, first one shed at c. 28 days. Clutches that hatch average 44% in *pinnatus*, 32% in *atwateri*; replacement clutches are usual; average brood size reduced in one study from 8.0 to 6.6 young. Sexual maturity at 1 year, but few yearling males mate. Annual adult survival rate 45% in males, 49% in females; one ringed bird observed at 8 years old.

Movements. Mostly sedentary; some birds, especially females and juveniles, may move 12-170 km between wintering and breeding areas, without any definite direction. As in *T. phasianellus*, in past movements may have been longer on average.

Status and Conservation. Not globally threatened. Despite conservation efforts, race *cupido* became extinct in 1932, having been confined to Martha's Vineyard I, Massachusetts, since c. 1870; market hunting and poaching thought to have played important role in decline. Race *atwateri* included in 1978/79 Red Data Book, classed as Rare; extinct in Louisiana in 1919; the remaining Texas population numbered c. 8000 birds in 1937, c. 2000 in 1970, c. 1500 in 1980, and under 1000 at present; only small part of population found in reserves. More widespread race *pinnatus* initially benefited by limited amount of agriculture and so greatly increased in numbers and range

by end of 19th century, but sharp declines followed further agricultural development, and now extirpated or endangered in 15 states and provinces; during the last 25 years has further decreased in 7 states and increased in just 2; total autumn population was estimated at c. 500,000 birds in 1979/80, about half the 1968/69 figure; largest remaining populations are in Kansas, Nebraska and South Dakota. Historical densities may have approached 2.5 birds/ha in optimum habitat. Still hunted in several states, with annual bags of c. 84,000 birds during late 1960's and c. 61,000 in late 1970's. Besides habitat alteration due to intensification of agriculture, other negative factors include excessive overgrazing in some areas and the invasion of woody plants in others; also pesticide use, reducing insect supply for chicks. Conservation measures now in progress in many areas, including establishment of reserves, reintroductions and restockings (not yet in Canada), control of predators, removal of competing introduced Ring-necked Pheasants (*Phasianus colchicus*) and especially habitat improvement through prescribed burning, manipulation of grazing pressure and provision of thick vegetation for protective cover.

Bibliography. Amman (1944, 1957), Anderson (1969), Arthaud (1968, 1970), Baker (1952), Ballard & Robel (1974), Berger *et al.* (1963), Bjørstad (1988), Bowen (1971), Bowman & Robel (1977), Buhnerkempe *et al.* (1984), Cannon & Christensen (1984), Chamrad & Doo (1973), Christensen (1969, 1985), Cogar (1980), Drobney & Sparrowe (1977), Eng *et al.* (1988), Etter (1963), Evans & Gilbert (1969), Flickinger & Swineford (1983), Greenway (1967), Gross (1928), Hamerstrom (1941), Hamerstrom & Hamerstrom (1949, 1961, 1973), Hoffman, R.W. *et al.* (1992), Horak (1985), Horkel (1979), Johnsgard & Wood (1968), Jørgensen (1977), King (1978/79), Kirsch (1974), Kirsch *et al.* (1973), Kohrner (1965), Korschgen (1962), Lawrence (1982), Lawrence & Silvy (1980, 1987), Lehmann (1941, 1968), Lumsden (1966), Lutz (1979), Ridgway & Friedmann (1946), Robel (1965, 1966, 1967, 1970), Robel & Ballard (1974), Robel *et al.* (1970), Schmidt (1936), Schroeder (1991), Schroeder & Braun (1991, 1992), Schroeder & Robb (1993), Schwartz (1945), Sharpe (1968), Silvy (1968), Sparling (1979, 1983), Svedarsky (1979, 1988), Svedarsky & Wolfe (1973), Terres (1980), Toeffer *et al.* (1980), Vance & Westemeier (1979), Viers (1967), Vohs & Knopf (1980), Watt (1969), Westemeier (1973, 1980), Yeatter (1943, 1963).

17. Lesser Prairie-chicken

Tympanuchus pallidicinctus

French: Tétraz pâle **German:** Kleines Präriehuhn **Spanish:** Gallo de las Praderas Chico
Other common names: Lesser Prairie Grouse, Lesser Pinnated Grouse

Taxonomy: *Cupidonia cupido* var. *pallidicincta* Ridgway, 1873, prairies of Texas near lat. 32° N. Frequently considered a race of *T. cupido*. Monotypic.

Distribution. SE Colorado, SW Kansas, Oklahoma, E New Mexico and NW Texas.

Descriptive notes. 38–41 cm; male c. 790 g, female c. 700 g. Tail blackish in male, barred in female. Very similar to *T. cupido*, but smaller, paler, less heavily barred below and with cervical sacs orange-red, rather than yellow. Immature and juvenile similar to those of *T. cupido*.

Habitat. Arid grasslands with interspersed dwarf oaks and shrubs. Originally in two main plant communities associated with sandy soils: sand sage-sand bluestem (*Artemisia filifolia*-*Andropogon*



hallii); and shin oak-sand bluestem (*Quercus havardii*-*A. hallii*). During winter, grass cover is used for all activities, but roosting also takes place in shrubby areas, and feeding in sites with oaks (for acorns). Display grounds appear in areas with fairly short grass, on ridges or other elevations, but in valley meadows if ridges have tall dense sagebrush. Species nests among low shrubs or between grass clumps; broods move to heavier cover, e.g. oak motts or sagebrush.

Food and Feeding. Similar to *T. cupido*, but with much higher percentage of insects, e.g. in Oklahoma, yearly volume of insects 41.8-

48.6% for present species, as opposed to 8.2-20.8% for *T. cupido*). During summer, insects are main food even for adults. Cultivated plants, such as sunflower and sorghum, sometimes important winter food, especially during snowy periods. In New Mexico, shin oak is main food resource throughout year.

Breeding. Laying Apr-May. Promiscuous; males form leks. Nest is hollow on ground, amongst long grass cover, primarily of bluestem. Lays average 11 eggs (6-14); incubation c. 24 days; downy young nearly identical to those of *T. cupido*. Clutches that hatch, c. 28% in New Mexico (less in areas of lower vegetation). Sexual maturity at 1 year old. Annual survival rate 32% for males in one study.

Movements. Largely sedentary. In Oklahoma, 79% recoveries within 3.2 km from ringing place 97% within 6.4 km, while maximum distance recorded was 16 km; juveniles and females tend to move farther.

Status and Conservation. Not globally threatened. Considered threatened by US Fish and Wildlife Service (1973). Like *T. cupido pinnatus*, present species increased temporarily with advent of agriculture, expanding northwards, but during 20th century has also experienced a major long-term decline. Total population amounted to c. 50,000 birds in autumn 1979, with c. 7500 in Oklahoma, 11,000-18,000 in Texas, 17,000-18,000 in Kansas, and 10,000 in New Mexico; these spread over c. 27,000 km², less than 10% of original range. Now apparently stable, with only local declines. Densities in favourable habitat can reach 4-12 males/km², but average 2.8 in Oklahoma. During late 1970's, c. 5700 birds killed annually by hunters. Spread of agriculture into areas of short-grass prairie, facilitated by deep-water wells and center-pivot irrigation equipment, is major threat; in Kansas, caused habitat to diminish during 1970's at annual rates of 1.5-6%. Other problems could derive from local overgrazing and the invasion of steppe by woody vegetation.

Bibliography. Campbell (1972), Cannon & Knopf (1979, 1981), Copelin (1963), Crawford (1978a, 1980), Crawford & Bolen (1975, 1976), Davis *et al.* (1979, 1980), Haukos & Smith (1989), Hoffman (1963), Horak (1985), Jones, R. (1963, 1964), Ridgway & Friedmann (1946), Riley (1978), Riley *et al.* (1992), Sell (1979), Sutton (1968), Taylor (1979), Taylor & Guthery (1980), Terres (1980), Wilson, D.L. (1982).

Class AVES
Order GALLIFORMES
Suborder PHASIANI
Family ODONTOPHORIDAE
(NEW WORLD QUAILS)



- Fairly small terrestrial birds with compact body, strong legs, and short wings.
- 17-37 cm.



- Neotropical and Nearctic Regions.
- Tropical, subtropical and temperate forests, forest edge, savanna and agricultural land, from sea-level to 3300 m.
- 9 genera, 32 species, 139 taxa.
- 2 species threatened; none extinct since 1600.

Systematics

The New World quails are found primarily in the Neotropical Region and in the southern part of the Nearctic Region. The earliest fossil evidence is of a quail-like specimen found in Saskatchewan, Canada, dating to the Lower Oligocene some 37 million years ago, while there are also more recent fossils from the Miocene, Pliocene and Pleistocene. The earliest fossils of modern genera include a *Cyrtonyx* from the Middle Miocene in Nebraska (USA), about 16 million years ago, a possible *Lophortyx* (*Callipepla*) from the Middle Pliocene in Oregon, about 6 million years ago, and a *Colinus* from the Upper Pliocene of Kansas, 1.5-3.5 million years ago.

The taxonomic status of the family, and also of the genera and species within the family, has been debated for many years. The family is often considered a subfamily of Phasianidae, and thus it is grouped at various taxonomic levels alongside the Old World quails, partridges, francolins, and pheasants. However, DNA-DNA hybridization evidence suggests that the New World quails are not closely related to Old World quails, turkeys or grouse, indicating an early divergence in South America during its isolation from North America. The divergence of the New World quails is variously estimated to have occurred 63 or 35 million years ago, with DNA-DNA hybridization supporting the earlier of these dates. Further evidence in favour of family status for the New World quails comes from the fact that they are not known to have hybridized with any other members of Galliformes.

The presence of the most generalized species and the rich number of genera from southern Mexico and Guatemala suggest early radiation of the family from that region. Three groups of genera have been identified, with *Dendrortyx* being the earliest representative. The genera predominantly adapted to the forest, *Odontophorus*, *Rhynchortyx*, *Dactylortyx* and *Cyrtonyx*, are found in Central and South America, whereas the genera adapted to forest edge, *Colinus*, *Callipepla*, *Oreortyx* and *Philortyx*, are found primarily in North and Central America. This division into groups on habitat use is additionally supported by the pelvic structure.

Amongst the genera of New World quails, *Callipepla* and *Lophortyx* have often been classified apart, but nowadays the two forms are most commonly united in *Callipepla*, as the

differences seem too slight to merit generic separation. R. J. Gutiérrez and others, using starch gel electrophoresis and fossil calibration, suggest, for the North American genera, the earliest radiation of *Oreortyx* some 12.6 million years ago, followed by *Colinus* 7 million years ago, and most recently by *Callipepla* 2.8 million years ago. They also suggest that *Dendrortyx* and *Odontophorus* diverged at least 16 million years ago.

The classification of species within genera has also varied greatly, and this issue is still very far from being settled. Of the nine genera in the family, *Odontophorus* has the greatest number of species, with a total of 15. However, there are two groups of *Odontophorus* wood-quails found in the northern Andes, which constitute a rusty-breasted complex of four species and a black-throated complex of five species; the members of these groups might actually turn out to represent smaller numbers of species. Several species in the genera *Callipepla*, *Colinus* and *Cyrtonyx* have also been merged by various authorities. A large number of natural hybrids have been reported among different species of *Callipepla*, and also with the Northern Bobwhite (*Colinus virginianus*). Although North American species have been analysed using a number of techniques, many South American species are presently classified with very little supporting evidence.

Morphological Aspects

The external appearance of the New World quails is very much like that of the Old World quails and partridges. In Latin America they are often lumped with the tinamous under the vernacular Spanish name "perdices". With their similar appearance, habitat and habits it is easy to mistake several species of these families where they occur together, even though they are not closely related.

The size range is not nearly as variable as that found in some of the other galliform families. The smallest species are the bobwhites (*Colinus*), the Barred Quail (*Philortyx fasciatus*), and the Tawny-faced Quail (*Rhynchortyx cinctus*), which are all slightly smaller than the average Northern Bobwhite. The largest species is the Long-tailed Tree-quail (*Dendrortyx macroura*), which is the size of a Grey Partridge (*Perdix perdix*).

The New World quails are small, compact birds, most of which have striking plumage, mainly in grey, black, white, buff, brown and reddish. Many species in the family have crests or other ornamental features on the head, such as the unusual teardrop-shaped plume found in Gambel's Quail and the California Quail (*Callipepla californica*). These adornments are normally more developed in the male, and it is believed that they play an important part in breeding displays, as, in many species, does the sharply contrasted pattern of the head and throat. This individual also illustrates the ease with which New World quails can perch on the sharp spikes of cacti. These plants are common in the xeric habitats to which most of the North American species are so well adapted.

[*Callipepla gambelii*,
Sonoran Desert, Arizona,
USA.
Photo: John Cancalosi/
DRK]





Most species of New World quail show marked sexual dimorphism in their plumage. Females lack the more distinctive patterns, or at least these are much less conspicuous and differentiated. The crest, rounded and particularly prominent on the back of the head in the Montezuma Quail, is also normally less pronounced in the female.

[*Cyrtonyx montezumae mearnsi*, Davis Mountains, Texas, USA. Photo: C. C. Lockwood/Bruce Coleman]

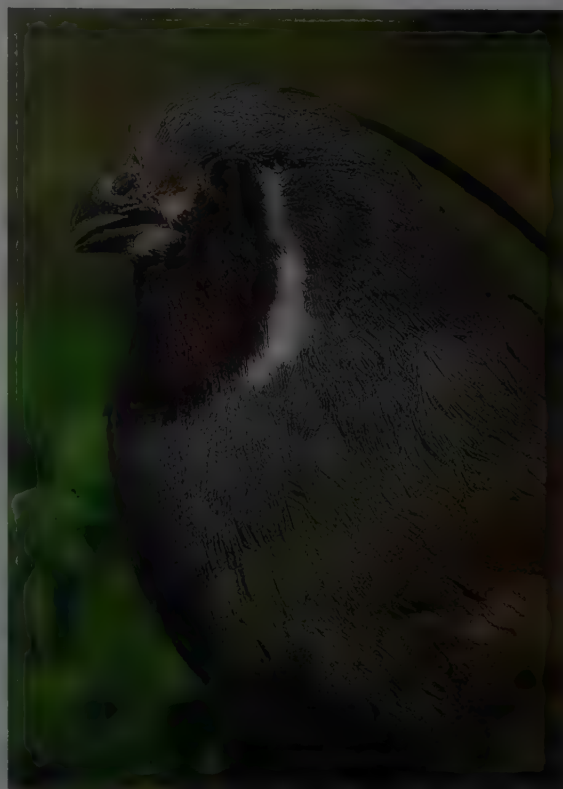
Almost all species are compactly built with a short neck, wings and tail. The exceptions are the three tree-quails (*Dendrortyx*), which have rather long tails. Several species have some form of ornamentation on the head, ranging from small crests, as commonly seen in the wood-quails (*Odontophorus*), to the long feathers in the shape of a teardrop found in California Quail (*Callipepla californica*), and the "spike" sported by the Mountain Quail (*Oreortyx pictus*). The bill is serrated, and, typical of seed-eaters, is short, stout and slightly decurved; it is especially short and stout in the wood-quails. In most species bill colour is black or grey, but two of the tree-quails have handsome red bills.

The ground-dwelling habits of most species are revealed by their short, powerful legs, as these are birds well designed for terrestrial locomotion. The tarsus is unfeathered and, unlike many of the Old World galliforms, none of these quails have tarsal spurs, in either sex. All species have three front toes and a raised hallux, or hind toe. The toes of many of the tropical species are especially long, which may be an adaptation for digging into the soil for roots and insects, rather than scratching in the litter for seeds, the norm for many of the more temperate species.

Although many species are powerful fliers over short distances, most apparently prefer to run rather than fly, when alarmed. When they do take to the air, they often start with a very steep take-off, but even then they usually fly only very short distances. As in other groups of Galliformes, the wingbeats are rapid, with alternating glides and little variation in direction. As most species live in groups, when alarmed birds will often explode from the ground in all directions, presenting a confusing spectacle to any potential predator.

Plumage colour ranges from very dull to a rather subtle spectacular. Most species have rather dull coloration and mottling, which is related to their shy, skulking behaviour. However, when viewed at close range, many species have striking red or purple eye-rings, or contrasting rows of white "teardrops" or spots on the breast. The Montezuma Quail (*Cyrtonyx montezumae*) exemplifies this contrast with a black base colour to the breast and belly covered extensively with brilliant white spots. Many species have strongly contrasted coloration on the face and throat, especially in males, and this probably performs functions in sexual displays.

There is some sexual dimorphism in plumage in almost all the species of this family. None, however, are as dramatic as the differences seen in several other Galliformes, notably some pheasants (see page 440). Typical sexual differences include the male being slightly larger, with slightly brighter plumage. Often, when a crest or some other form of ornamentation is present, it is larger in the male. A contrasting coloration in the region of the face and throat is often a dramatic black or white



The general appearance of the Odontophoridae is very similar to that of the Old World partridges, but there are some striking differences. One of these is the stronger, very pointed bill, which has more or less serrated edges, as can be seen in this Mountain Quail. This species is unique in the form of its crest, which consists of two immensely long, thin head plumes that often appear to be joined together in one.

[*Oreortyx pictus*, Western Mountains, USA. Photo: Erwin and Peggy Bauer/Bruce Coleman]

Many New World quails, such as the Northern Bobwhite, can fly quite strongly, with rapid wingbeats, but only for short distances. Unlike some Old World quails, no member of the Odontophoridae performs true migrations, but dispersive movements after breeding are typical, as are altitudinal movements in species which inhabit mountainous areas.

[*Colinus virginianus mexicanus*, Ohio, USA.

Photo: Steve Maslowski/FLPA]



in the male, but a much duller buff or mottled brown in the female.

Plumage development is fairly consistent among all the different groups of galliforms. Feather tracts are similar and the presence of insulating aftershafts on contour feathers is common. Moulting occurs in chicks at a very young age, when they are passing through a period of rapid development (see Breeding). Among well studied species, first-year birds are often distinguishable from older ones by the tendency for the outer two primaries on each wing to be pointed and frayed, as these two outermost flight-feathers are not moulted in the first year like all the others. The number of primaries is consistently ten, but the number of secondaries varies from 14 to 16, although

these feathers grade into the scapulars, so that it is not always easy to make a clear separation.

Common to this group and other Galliformes is the presence of a blind sac in the cloaca called the bursa Fabricius. This structure, located on the dorsal wall of the cloaca, is larger in immature birds and decreases as the animal matures. It functions in antibody production, and has been used for ageing in a number of galliform species.

Habitat

The New World quails now inhabit a variety of ecosystems ranging from tropical rain forests to desert scrub. The group shows a strong preference for subtropical and mild temperate climates, and there is very limited representation in the colder temperate climates of North America. The Northern Bobwhite and the Mountain Quail range into cold climates, but even they can not tolerate the low temperatures endured by many of the Old World Phasianidae or the grouse (Tetraonidae).

The greatest diversity of species is associated with Neotropical forests. The wood-quails (*Odontophorus*), which represent almost half of the species in the family, are found in tropical rain forest, subtropical forest, montane and cloud forests, and deciduous forest. Most of the species in this genus are found in thick underbrush in these habitats, although a number of species can be found at forest edges and in second growth. Several species have been reported to use coffee plantations, but they appear to use coffee grown under bananas or other trees, rather than open fields of coffee.

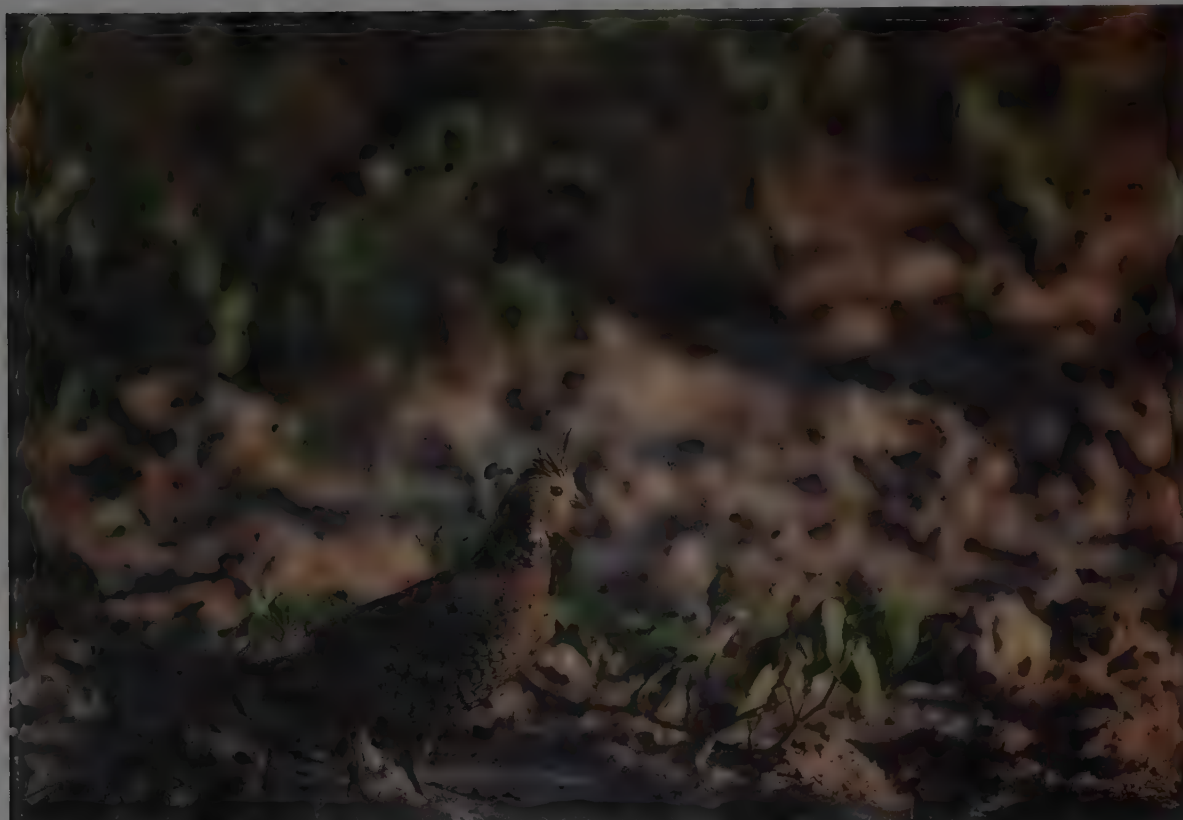
The species found in North America are the best adapted to xeric conditions and, not surprisingly, to a temperate climate. Most still show their forest edge affinities, but several species are found in desert scrub and even in agricultural habitats. The bobwhites (*Colinus*) have also exploited more xeric ecosystems in Central America and northern South America. The Northern Bobwhite is one of the species that has adapted most fully to the temperate zone, where it utilizes both forest and open habitats. In the south-eastern USA, some of the densest populations are found in open pine woodlands with a well developed under-

New World quails use a very wide range of habitats. Most species inhabit various kinds of woodland, but some are well adapted to agricultural areas and even arid or semi-arid zones, as is the case of the Scaled Quail. The common name of this species comes from the dark edges to the feathers of the breast and mantle, which produce a shingled or scaly effect. Another distinctive characteristic of the species is its conspicuous white-tipped crest.

[*Callipepla squamata pallida*, Arizona, USA.

Photo: John Shaw/NHPA]





Unlike the North American species of the family, which frequent open areas and even markedly arid zones, only one of the South American species, the Crested Bobwhite, favours this type of habitat. It is found in and around thickets, savanna, grassland, embankments, roadsides and cultivated land, but it does not enter the forest interior, although it can be found in the margins. All the other South American species are predominantly, or exclusively, forest dwellers.

[*Colinus cristatus parvicristatus*, La Ye, Apure, Venezuela. Photo: A. Greensmith/Ardea]

storey of wiregrass (*Aristida stricta*). In the Midwest, populations are frequently associated with grassland and intensive agricultural ecosystems.

An interesting habitat adaptation is found in the Montezuma Quail and the Ocellated Quail (*Cyrtonyx ocellatus*). Both of these species are found in open pine or oak woodlands, but both depend heavily on the bulbs and tubers of a number of different types of herbaceous plants, most notably wood sorrels (*Oxalis*).

General Habits

The New World quails are shy and elusive, and they invariably prefer to hide and crouch in the vegetation, when alarmed, rather than flying away. If they do move off, many species are more likely to slip away unnoticed than to flush, but when a flock is flushed, take-off is often explosive, with birds flying off in many directions.

These are highly gregarious species, which regularly live in groups. After breeding, birds often move about in family groups, which consist of the two adults and their offspring. However, outside the breeding season, a number of temperate species, such as the California Quail, will congregate in large flocks, which can number up to 1000 individuals, when the conditions are suitable.

Most species are apparently diurnal, and are thought to spend the majority of their time on the ground. Indeed, all of the North American species live on the ground, and they generally roost on the ground at night. The tree-quails (*Dendrocygna*) of Central America are probably the most arboreal species, and at night they roost in tall trees; nevertheless, they are reported to feed mainly on the ground. Tree-roosting has also been reported for the Barred Quail, although this is essentially a species that occupies scrub. There are some accounts of Venezuelan Wood-quails (*Odontophorus columbianus*) roosting in rows along palm fronds, while it has also been claimed that the Chestnut Wood-quail (*Odontophorus hyperythrus*) roosts in trees. It seems that this habit might be more common in wood-quails than has been realized up to the present.

Voice

The rather primitive, poorly developed tracheal syrinx found in the Odontophoridae results in a rather simple vocal repertoire. However, despite this mechanical limitation, some species are reported to boast a fair number of distinct calls.

The Northern Bobwhite has a minimum of 19 distinct calls, and perhaps up to five others, whereas 10-14 different calls have been reported for the species of *Callipepla* found in the western USA. Most of the variation in types of call is related to the courtship behaviour of males, but other common calls in these species include various kinds of separation calls for regrouping, feeding calls and alarm calls. Among the bobwhites, calls are often a whistle-like "bob-white", whence the common name. In contrast, the *Callipepla* quails have calls resembling shrieks and chipping sounds, as well as some whistles. The calls of tree-quails consist of a loud hooting and grunting, which is often performed in chorus. Amongst the wood-quails, calls tend to be rolling and guttural, and in south-western Colombia rural people call the Chestnut Wood-quail "aguacero vientoado", meaning "rain with wind", a description of the sound of its call.

In the cases where information is available, calls are most often concentrated around dawn and dusk, and with greater frequency during the breeding season. Group calls are found in a number of species, and in the Venezuelan Wood-quail these often become raucous choruses, with up to nine birds in a group. It is interesting to note that duetting has been reported among pairs of Marbled Wood-quails (*Odontophorus gujanensis*). This behaviour might be found to be more widespread among the wood-quails, when other species have been more fully studied.

Food and Feeding

Most of the species in this family tend to be generalists and opportunists in terms of the food they take. The long lists of types of food consumed that are available for several of the better studied species are testament to this lack of specializa-

tion. Many of the Central and South American species are in great need of more detailed studies of their food requirements.

The majority of species that are mainly adapted to living in xeric areas are seed-eaters, but most of them will also consume green vegetation, tubers, buds and insects. The tree-quails of Central America also consume a diversity of foods, but they are more likely to feed in trees than other genera, even though they too are reported to feed mostly on the ground. The wood-quails are reported to feed on a diversity of food types, but they may consume more animal food and roots. The Montezuma and Ocellated Quails, in turn, depend heavily on tubers.

Virtually all of the species in which the feeding habits have been studied show an increase in the consumption of insect and animal foods during the breeding season. This diet pattern is reported in many other species of Galliformes, and is attributed to the need for food with higher protein value during breeding. Again, in these same species the chicks have also been found to require insects during their first few weeks after hatching, when their growth rate is fastest.

Foraging patterns are rather diverse, reflecting the variety of food types consumed. The species inhabiting xeric parts of the western USA tend to peck at food rather than scratch for it, although most species will also scratch in the litter for seeds. These species are also more likely to eat green vegetation and succulents in order to procure water, a common tendency of animals living in such dry conditions. However, some species, such as the California Quail, are associated with standing water during the dry season.

The Montezuma and Ocellated Quails and also the wood-quails, all species that regularly eat tubers and roots, have long, powerful legs and toes, which are well suited for excavating soil. These species often forage in rows, clearing long paths through the leaf litter of their forest habitats. Tell-tale signs of wood-quails during the dry season are the rustling of leaves and flying litter, as a line of birds clears a path along the forest floor; the cleared areas often run along the edges of surface roots or rocks.

Breeding

The breeding biology of most of the Neotropical species of New World quails is neither well studied nor well understood, and a good deal of the very limited information available is anecdotal. Much more research is required on the diversity of reproductive patterns in this interesting group. In this aspect, as in most others, the vast majority of what is known refers to the species found in the USA.

Most species are apparently monogamous, although there are indications that this might not necessarily be the case for some wood-quails. As is to be expected, those species inhabiting temperate areas tend to breed in spring and early summer, with laying mostly from about April onwards. The season is rather more variable in the tropics, but typically coincides with the local wet season.

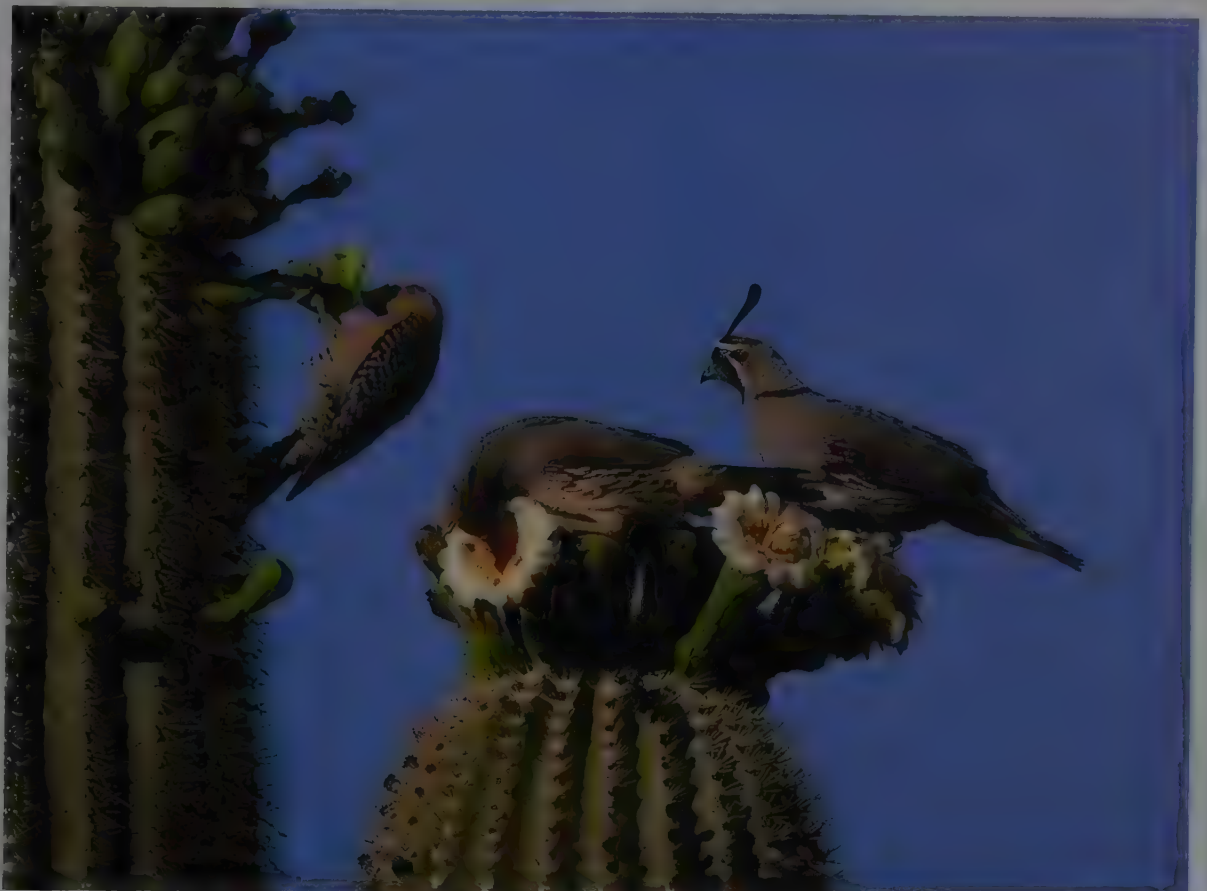
Courtship displays in North American species incorporate a number of frontal and lateral postures by males. These can include the use of the brightly coloured throat or the crest, while the wings are often dropped or spread. "Tid-biting" (see page 458) is common, and calls are often used in conjunction with visual displays. Nonetheless, most of the courtship activities of the New World quails are not nearly as dramatic as many of their galliform relatives.

The nest is almost always made on the ground, and it usually consists simply of a shallow depression lined with vegetation. It is most often hidden from above by thick vegetation, but some of the wood-quails actually construct domed nests with a long tunnel entrance.

As in most of the Galliformes, clutch size is considerably larger than in most other groups of birds. Typical clutch size is about 10-15 eggs for bobwhites and other North American species, as well as their congeners, but 3-6 eggs might be more typical of the tree-quails and wood-quails of Central and South America. For a few well studied species, such as the Northern Bobwhite, there are records of intraspecific brood parasitism, with one or more females laying in another female's nest. It is

The flowers and sweet fruit of the saguaro constitute an important food source for those species, such as Gambel's Quail, that are found in the semi-deserts where this cactus thrives. However, the diet of this quail species is actually quite varied and includes seeds, flowers and fruits of many plants, as well as assorted grasses. In contrast, for the Gila Woodpecker (*Melanerpes uropygialis*), seen here in the background, the fruit of the saguaro, when available, is its main source of food.

[*Callipepla gambelii*.
Photo: François
Gohier/Ardea]





Northern Bobwhites generally form coveys, except early in the breeding season, when they are found in pairs. At the beginning of the summer the covey is made up of the family group, including both of the adults and the chicks. Other birds gradually join, from other coveys which have been decimated by predation or disease, or birds that have, for various reasons, become isolated. At the beginning of autumn, it is common for the coveys to begin to mingle, with many birds swapping covey affiliation in a process known as the "fall shuffle". Finally, in spring, the coveys disperse, as birds pair off in preparation for breeding.

[*Colinus virginianus*.
Photo: Leonard Lee Rue/
FLPA]

interesting to note the presence of brown or red spots on the mainly whitish eggs of many of the Neotropical species: because the breeding season of these species often coincides with the wet season, there is the potential for the leaching of colour onto the shells, and it seems that these spots are thus the result of staining by the vegetation or soil in the nest. The California Quail and Gambel's Quail (*Callipepla gambelii*) are both known to lay a second clutch on occasions.

The incubation period appears to vary widely among the different species, but it should be noted that in several cases where estimates are available for a particular species, the data have actually been collected from very few individual clutches. For the better known species, incubation ranges from 21-23 days in *Colinus* and *Callipepla*, to 25-26 days in *Cyrtonyx*. Among the poorly studied wood-quails, reports include estimates of 16-17 days for the Black-breasted Wood-quail (*Odontophorus leucolaemus*), 18-19 or 26-27 days for the Spotted-winged Wood-quail (*Odontophorus capueira*), 24-28 days for the Marbled Wood-quail, and 30 days for the Venezuelan Wood-quail.

Chicks are nidifugous, and, soon after hatching, wander off from the nest guarded by the female or both adults in a family group. At this stage, the chicks grow very rapidly, and the primaries and secondaries are acquired early on, so that the chicks of some species are capable of short flights at less than 14 days of age.

The amount of male parental care varies with the species. Male assistance during incubation has been reported in some cases, especially in the latter stages and around the time of hatching. As the breeding biology of more species becomes better known, so male assistance with the tasks of incubation and brood-rearing will undoubtedly be more commonly reported. In some of the wood-quails, there are reports of guarding behaviour near the nest by adults other than the parental pair, but this anecdotal information needs to be confirmed by more intensive studies.

The New World quails are generally species with short lives, high mortality, and high reproductive rates. Annual survival rates of the better studied species in the USA very rarely top 30%. Nesting success rates of 20-40% are commonly reported for the Northern Bobwhite, but adults are persistent reneesters. Brood mortality is often over 20%, and losses of even

30-50% are not uncommon, with the result that life expectancy is usually under one year. It is not surprising then that the productivity of these species is very high. There is a trend toward smaller clutch sizes in the forest-adapted species found in Central and South America; there are virtually no estimates of lifespan and mortality rates for those species, but with the much lower productivity rates, it would not be surprising if there were greater adult survivorship.

Movements

The major mode of movement for the species in this group is walking, and this is consistent with the idea that virtually all species would be considered sedentary. Home range is very small, typically under 40 hectares among the better studied species found in the USA.

Altitudinal migration has been reported in the Mountain Quail and it is suspected in the Spotted Wood-quail (*Odontophorus guttatus*), but there is no evidence of similar movements in other species. The most mobile species in this family are the Scaled Quail (*Callipepla squamata*), which has been known to move up to 100 km, and the Mountain Quail, with reported movements of over 50 km. However, these types of movement are probably exceptional, and the sort of distances more typical travelled by Scaled Quails are of less than two kilometres.

Relationship with Man

Like most of the other galliforms, the New World quails have a long history of association with man. This association has been both beneficial and detrimental at times, depending on the perceived value of the particular species and the land use practices.

Pre-Columbian cultures in North and South America utilized a number of different species of quails as food sources. In some of these cultures, there were periods when the potential for overexploitation existed. Alterations of habitat were at times liable to have a negative impact on some species, and at the same time positive effects on others. Mayan agriculture in

It appears that the Spot-winged Wood-quail is monogamous, at any rate in captivity. On the left of this photo is the characteristic nest of this species, a shelter built on the ground of dry leaves, with a side entrance and a substantial roof which prevents the white eggs from being seen from above. Also clearly visible here are the bright red eye-ring and the broad tawny orange supercilium, the most distinctive features of this species.

[*Odontophorus capueira*,
Brazil.

Photo: R. Seitre/Bios]



southern Mexico and northern Central America consisted of a mosaic of *milpas* in forest areas and raised bed agriculture in lowlands. This had the potential of increasing the populations and distribution of both the Northern Bobwhite and the Black-throated Bobwhite (*Colinus nigrogularis*), but it might equally have been detrimental to forest-dwelling quails. Very dense human populations in the region at the same time may well have taxed quail stocks.

In North America, native tribes in the east were known for using fire to alter the expansive forest ecosystems. The Northern Bobwhite no doubt benefited from these habitat alterations, but, nevertheless, evidence suggests that this species was not an important food item. In western North America, the California Quail was highly esteemed as a source of food by the native tribes, and the "top-knot" was used for decoration on clothing. It has been suggested that the population of California Quails on the island of Santa Catalina, off Los Angeles (USA), was originally introduced by local Indians, and certainly there is evidence of rural peoples in Latin America having kept several quail species as pets. One problem with our understanding of quail use throughout history is that even today there is little distinction made between the quails, tinamous and cracids of the region.

The combined factors of European settlement in the New World, fairly dramatic changes in the landscape, and interest in quails for sport and food have led to the distributions and populations of species that we find nowadays. The extensive logging and then reforestation of the eastern USA since the seventeenth century has had a dramatic impact on the distribution and populations of the Northern Bobwhite. This species was very important during the eras of settlement and hunting for markets, and it probably suffered periodically as a result of these pressures. Despite market hunting pressure, populations are thought to have increased generally in the USA until the middle to late nineteenth century, due to forest clearing; most of the population declines have, in fact, occurred during the latter half of the twentieth century. A similar pattern of population change has also been described for the California Quail. Both of these species and the other quails in the western USA are presently important in the business of hunting for sport, and in some areas extensive management is carried out for these species.

The early impacts of European settlers on other North American quails were probably considerably less significant, but they too were no doubt heavily harvested during settlement. Exploitation of quails in Latin America during and after European settlement probably paralleled the North American situation, but it is less well documented. Although many species of quails are considered eminently edible in Latin America, their small body size limits demand. It is interesting to note that in south-west Colombia the Crested Bobwhite (*Colinus cristatus*) is said to be "maldito" and should not be eaten; this translates to "cursed" or "damned", in reference to the Virgin Mary being frightened when she flushed a covey of Crested Bobwhites! There is some hunting for sport, especially for the bobwhites, in agricultural areas of northern South America, and, in connection with this, some hunting regulations do exist in a few countries.

Several species of New World quails have been widely transplanted within the region and also to other parts of the world. The Northern Bobwhite and the California Quail have been extensively relocated, both from wild-trapped birds and from those raised in captivity, and it has now been suggested that the decline of the Northern Bobwhite in the north-eastern USA may have been accelerated by the release of large numbers of southern and pen-raised quails.

Both the Northern Bobwhite and the California Quail are naturalized well beyond their natural ranges. The California Quail is well established in New Zealand and Argentina, while the Northern Bobwhite is well established in several parts of the western USA, and in limited numbers in New Zealand. From South America, the Crested Bobwhite has been introduced and is now established on several Caribbean islands. Most of the other North American species have been introduced at one time or another in other parts of the USA, Europe, New Zealand and Australia, though generally without success.

Several of the New World quails are represented in some zoos or private collections, although they are generally not as popular as some of their galliform relatives. For example, specimens of many of the wood-quails can be found in one or more South American zoos, but most of these collections are small, containing only one to a few birds. Apart from a few North American species, members of Odontophoridae are rarely bred in captivity. The exception might be some of the



Although several other New World quail species seem to be able to get by with succulent plants, the California Quail selects its dry season habitat in accordance with its need for springs, streams, irrigation ditches or other permanent sources of drinking water. While incubation is carried out only by the female, the male, here partly hidden by the female, also participates in the care and guarding of the chicks.

[*Callipepla californica*.
Photo: Wardene Weissner/
Ardea]

collections of bobwhites found in Latin America, where there are reports of commercial breeding for eggs and for release.

Status and Conservation

The current status of the New World quails ranges from a species that may be critically endangered to others which are common and widespread. In order to detect any serious declines before it is too late to act, efforts are being made to determine the current situation and conservation requirements of all species, and this has been the main aim of the Conservation Assessment project (see page 472).

All of the better known species, those found predominantly in the USA, are widespread and common. Several of these species are widely hunted on a sustainable basis, and some are intensively managed for hunting, notably Northern Bobwhites, of which over 20 million are killed in the USA each year. But there is now concern regarding the trends in some populations of these species. Although populations of the Northern Bobwhite in the southern plains of the USA are stable to increasing, populations in traditional areas of the south-eastern and north-eastern USA have been undergoing a rather dramatic long-term decline. Much of this decline has been attributed, at least in part, to changes in land use. In the south-east, forestry practices directed towards the short-term rotational clear-cutting of pines are detrimental to populations. More traditional selective cutting and understorey burning, creating open pine woodlands with a grass understorey, result in much higher populations of quails. In the western USA, populations of California Quails and Scaled Quails have dwindled since 1960. The Mountain Quail has declined dramatically in the north-eastern portion of its range, but overall populations are stable.

Although Mexico contains the greatest diversity of quail species, including all of the species also found in the USA, very little is known about the conservation status of any of the species. Of the 11 polytypic species with ranges including Mexico, 60 of the 85 subspecies described are present in Mexico. Even for the well studied Northern Bobwhite, little is known about Mexican populations, although 16 of the 22 subspecies

are found there. An isolated subspecies, the Masked Bobwhite (*C. v. ridgwayi*) has only recently been studied in Mexico.

Among the species more adapted to xeric conditions, overgrazing can create problems by reducing both the vertical structure of the vegetation and the food supplies, although many of these species actually undergo population increases when their habitat is under light or moderate grazing by livestock. Livestock can even have impact on forest species, such as the Montezuma and Ocellated Quails, where grazing in the forest reduces the availability of important food plants.

Very little information is available for most of the forest-dwelling species of Central and South America. The Bearded Tree-quail (*Dendrortyx barbatus*) is considered the most critically threatened species in this group. Its former distribution was in the cloud forests of eastern Mexico, but these have now mostly been cleared. Surveys in the late 1980's revealed some populations, but these were not found again during subsequent searches in the 1990's; more intensive surveys for this species are planned for 1994. The other species currently considered to be seriously threatened is the Gorgeted Wood-quail (*Odonotophorus strophium*). This species was found in montane oak forests in the eastern Andes of central Colombia. A survey in the 1980's located populations in the vicinity of Virolin, Santander Department, and efforts have subsequently been made to establish a reserve there.

Several species of wood-quails are reckoned to be near-threatened mainly on the basis of their limited distributions, in conjunction with alterations of their habitat that are known to be occurring. Unfortunately, not enough is really known about many species to enable very accurate conservation assessments to be made. Nevertheless, the conversion of forest to agriculture in many parts of Central and South America must be considered a threat to many of these species, although it is not yet known how tolerant most species are to the fragmentation of the forest, or how well they can adapt themselves to use second-growth forest. The inconclusive evidence of scattered observations suggests that several species will utilize shaded fields of coffee, but not those plantations that lack the shade trees. However, at the same time there may also be some reason for concern about the possible impact that the pesticides used in the cultivation of coffee could have on these species.

The Long-tailed Tree-quail and the other two species of the genus *Dendrortyx* are, as their name suggests, the most arboreal members of the family. They roost in trees, sometimes at great heights, although they feed mainly on the ground. They are the largest of the New World quails, with the longest tails. Six subspecies have been described for the Long-tailed Tree-quail, all of them endemic to Mexico.

[*Dendrortyx macroura*, Mexico.]

Photo: Patricio Robles Gil]



Fortunately for a number of species with restricted ranges, such as the Venezuelan and Chestnut Wood-quails, there are national parks and reserves to protect some remaining habitat, but these isolated patches of suitable habitat are ever vulnerable to catastrophes, so that the status of these quails hangs in the balance. In addition, the distribution of parks and reserves is uneven in many zones: for example, in the western Andes several national parks help protect some of the remaining tracts of cloud forest, but there is little protection for forests at lower altitudes, and virtually no protection in the lower river valleys.

Although deforestation and agriculture may be considered the major threats to the forest quails, several other threats that are present might be important in some areas, for instance urbanization and hunting, which could both affect populations of quails. To date, outside the USA, no studies have been

carried out concerning the impacts of hunting on quail numbers. There is widespread but rather sporadic hunting of quails by indigenous peoples throughout much of Central and South America. Fortunately for the quails, the combination of their small size and the presence of many alternative prey species means that quails are often not considered worth the cost of a shotgun shell. The effects that hunting pressure might have on quail populations in the future, as alternative prey species decline due to deforestation, remain to be seen, but it is clear that the threat may well increase.

In addition to the rather intensively managed species in the USA, there are several other species that are apparently experiencing increases in terms of both population and distribution, due to the activities of humans. For instance, as a result of deforestation, the Crested Bobwhite has recently expanded its range into Costa Rica, where it may now be coming into contact with the Spot-bellied Bobwhite (*Colinus leucopogon*). The Crested Bobwhite is very common in the llanos of Venezuela and in parts of the major river valleys of Colombia, while the Spot-bellied Bobwhite is likewise common in Costa Rica. Nevertheless, there is some concern even for these species, which parallels the concerns for Galliformes inhabiting agricultural ecosystems in other parts of the world. The impacts of agricultural intensification and of the abundant use of pesticides are still unknown in this region, but they could prove to be very important.

Despite the existence of such threats, the first step that must be taken towards assuring the future of many of the Neotropical species involves a thorough study of the ecology, and in particular the habitat use, of such species. The paucity of data currently available on distribution, populations and precise habitat requirements limits the possibilities of making accurate conservation assessments and recommendations.

General Bibliography

- Alderton (1992), Brodkorb (1964), Carroll, Church & Kelsev (1994), Carroll, Kuvlesky *et al.* (1994), Delacour & Ridley (1985), Gutiérrez (1993), Gutiérrez *et al.* (1983), Johnsgard (1988), Kuroda (1970), McGowan, Carroll & Ellis-Joseph (1994), Peters (1934), Prager & Wilson (1976), Raethel (1988), Robbins (1981), Rutgers & Norris (1970), Sibley & Ahlquist (1990), Sibley & Monroe (1990), Sibley *et al.* (1988), Stock & Bunch (1982), Vaughan (1990), Verhegen (1956).

The Bearded Tree-quail is the most seriously threatened member of the family. It is thought to be in a critical situation, and its total population may not reach 1000 birds. Destruction of its forest habitat within its restricted range appears to be the main cause of its decline, although hunting and trapping have also played their parts. This bird was acquired with various other birds in a local market in Hidalgo, Mexico, in 1992.

[*Dendrortyx barbatus*, Mexico.]

Photo: Josep del Hoyo/ Lynx]



Genus *DENDRORTYX* Gould, 1844

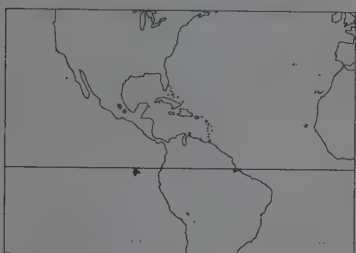
1. Bearded Tree-quail

Dendrortyx barbatus

French: Colin barbu **German:** Bartwachtel **Spanish:** Colín Barbudo
Other common names: Bearded Tree-partridge/Wood-partridge

Taxonomy. *Dendrortyx barbatus* Gould, 1846, Jalapa, Veracruz, Mexico. Monotypic.

Distribution. EC Mexico. Formerly in Sierra Madre Oriental, from S San Luis Potosí to C Veracruz and Puebla; recently known only from Hidalgo.



Descriptive notes. 22-32 cm; estimated weight of male 459 g, of female 405 g. Tail longer in *Dendrortyx* than in other members of family; much shorter in present species than in congeners. Overall coloration reddish brown, with breast rufous cinnamon; cheeks, throat and upper breast bluish grey. Crown and short crest buffy brown; eyering, bill and legs red. Female smaller, with shorter tail. Immature has dark brown barring on flanks, and duller breast.

Habitat. Cloud forests and adjacent pine and oak forests at 1200-2200 m; local reports claim species was formerly present in Hidalgo in primary forest remnants at elevations of less than

915 m. Other reports indicate that birds can visit planted fields in forest clearings, when black beans ripening; known to use second growth forest, forest edge, gardens and bean plantations. Roosts above ground in trees.

Food and Feeding. One stomach contained fruit and seeds. Captive birds ate black beans and corn; also soft fruits, such as grapes and bananas. May eat ripe black beans in wild.

Breeding. Nesting season may be Apr-Jun; female with downy chicks recorded in Jun. Brood of 5 chicks said to have been captured in wild. In captivity, birds constructed nest in shallow depression with palm leaves. Eggs dull white, averaging 46.6 x 31.0 mm; incubation 28-30 days in captivity.

Movements. Presumably sedentary.

Status and Conservation. ENDANGERED. Mace-Landé: Critical. Restricted range; very little information available, but situation reckoned to be serious, as locally extinct in parts of range and severely threatened elsewhere. Total population might number less than 1000 birds; apparently still decreasing; locally common in small areas. Not recorded from San Luis Potosí since 1951, nor from Veracruz since 1968. Several patches of suitable habitat remain, where populations might occur, but most of cloud forest in former range now completely deforested. Main threats are rapid deforestation and hunting; illegally hunted and poisoned in places because of depredation on beans; sometimes trapped for sale in local markets. Three national parks in Veracruz include areas where species known to have occurred, but not recorded in recent years. Urgently requires research, surveys and conservation action in order to halt potential extinction.

Bibliography. Alderton (1992), Blake (1953), Collar & Andrew (1988), Collar *et al.* (1992), Davis (1952, 1972), Edwards (1989), Howell & Webb (1992b), Johnson (1973, 1988), Leopold (1959), Lowery & Newman (1951), Martin (1955), Ridgway & Friedmann (1946), Robbins (1981).

2. Long-tailed Tree-quail

Dendrortyx macroura

French: Colin à longue queue **German:** Langschwanzwachtel **Spanish:** Colín Rabudo
Other common names: Long-tailed Tree-partridge/Wood-partridge

Taxonomy. *Ortyx macroura* Jardine and Selby, 1828, Mexico = Valley of Mexico. Six subspecies recognized.

Subspecies and Distribution.

- D. m. macroura* (Jardine & Selby, 1828) - México (state) and Veracruz, EC Mexico.
- D. m. diversus* Friedmann, 1943 - NW Jalisco, WC Mexico.
- D. m. griseipennis* Nelson, 1897 - Pacific slope in México, Distrito Federal and Morelos, C Mexico.
- D. m. striatus* Nelson, 1897 - S Jalisco, Michoacán and Guerrero, WC Mexico.
- D. m. inexpectatus* Phillips, 1966 - Chilbancingo and Guerrero, S Mexico.
- D. m. oaxacae* Nelson, 1897 - W Oaxaca, S Mexico.



Descriptive notes. 29-37 cm; 350-465 g (unsexed), with male c. 450 g, female 374-446 g. Very long tail. Forehead, sides of head, throat and foreneck black; two white streaks above and below eye. Overall coloration chestnut and grey; breast bluish grey; upper back chestnut with wide grey margins; pale markings on wings and tail. Crown and short crest black with buff streaks; eyering, bill and legs red. Female smaller, with shorter tail. Immature spotted with dark brown on underside; less chestnut on breast. Races separated on coloration, notably on rump and breast; *oaxacae* has breast too boldly marked chestnut.

Habitat. Montane oak and pine forest and cloud forest at 1500-3300 m. Most often in dense undergrowth. **Food and Feeding.** Feeds on flowers, flower buds, small fruits and seeds. One crop contained various legumes, especially *Desmodium*. Scratches in leaf litter and humus, but also feeds in trees.

Breeding. Nesting season from late Apr, possibly to Dec. Two nests associated with rocky outcrops, another found at base of shrub; one nest (amongst rocks) covered by leaves and twigs from fallen tree, but other two not covered. Three clutches of 4 eggs; one with 6 eggs, but possibly referring to 2 females. Eggs pale cream with light brown spots, averaging 49.2 x 33.5 mm.

Movements. Sedentary.

Status and Conservation. Not globally threatened. Mace-Landé: Safe. Status generally unknown; total population might number in region of 20,000-200,000 birds; possibly decreasing. Probably suffers habitat loss and some hunting pressure, but apparently not at risk. Extensive surveys required.

Bibliography. Alderton (1992), Biggs (1954), Binford (1989), Blake (1953), Davis (1972), Edwards (1989), Johnson (1973, 1988), Leopold (1959), Phillips (1966), Pielka (1948), Ridgway & Friedmann (1946), Rowley (1966, 1984), Schladach (1963), Skutch (1947b), Warner (1959), Zimmerman & Hurry (1951).

3. Buffy-crowned Tree-quail

Dendrortyx leucophrys

French: Colin à sourcils blancs **German:** Guatemala wachtel **Spanish:** Colín Cariclaro
Other common names: Buffy-crowned Tree-partridge, Highland Wood-partridge, Buff-fronted Quail

Taxonomy. *Ortyx leucophrys* Gould, 1844, Cobán, Vera Paz, Guatemala.

Race *hypospodius* has been considered separate species. Birds of Honduras and Nicaragua formerly awarded separate race, *nicaraguae*, but now included in nominate *leucophrys*. Two subspecies recognized.

Subspecies and Distribution.

- D. l. leucophrys* (Gould, 1844) - S Mexico (Chiapas), Guatemala, Honduras, E El Salvador and W Nicaragua.
- D. l. hypospodius* Salvin, 1896 - N Costa Rica.



Descriptive notes. 32-35.5 cm; estimated weight of male 397 g, of female 340 g. Fore-crown, supercilium, chin and throat white; ear-coverts black. Overall coloration chestnut and grey; breast and belly blue-grey with chestnut streaks. Crown, short crest and hindneck chestnut. Bare red eyering more elongated than in other *Dendrortyx*; bill black, legs orange-red. Female smaller, with shorter tail. Immature has buffy tips to greater primary coverts. Race *hypospodius* larger, rather darker and greyer, especially on underparts.

Habitat. Montane oak and pine forest and cloud forest at 300-2900 m. Found in second

growth and occasionally in coffee plantations. Roosts above ground in trees.

Food and Feeding. Seeds, flower buds and small fruits, including drupes. Has been observed scratching in oak leaf litter on forest floor.

Breeding. Recorded in May in Guatemala, Feb-Mar in El Salvador; chicks half-grown during Apr-Jul, Jun-Sept in Costa Rica. Possibly 4-5 eggs. Eggs reddish buff with reddish brown spots, averaging 44 x 30 mm.

Movements. Apparently sedentary. Moves about in coveys of 4-6 birds, but up to 12 during non-breeding season.

Status and Conservation. Not globally threatened. Mace-Landé: Safe. Virtually nothing known; total population might number in region of 20,000-200,000 birds; possibly decreasing. Deforestation may be a threat in some parts of range; some trapping known to occur. Extensive surveys required.

Bibliography. Alderton (1992), Baepfer (1962), Blake (1953, 1977), Diekmann (1987b), Dickey & van Rossem (1938), Edwards (1989), Griscom (1932), Johnson (1973, 1988), Land (1970), Leopold (1959), Montre (1968), Ridgely & Gwynne (1989), Ridgway & Friedmann (1946), Saunders *et al.* (1950), Slud (1964), Stiles & Skutch (1989), Wagner (1953), Wetmore (1941).

Genus *OREORTYX* Baird, 1858

4. Mountain Quail

Oreortyx pictus

French: Colin des montagnes **German:** Bergwachtel **Spanish:** Colín Serrano

Taxonomy. *Ortyx picta* Douglas, 1829, New California = Linn Co., Oregon, USA.

Race *palmeri* considered synonymous with nominate. Five subspecies recognized.

Subspecies and Distribution.

- O. p. pictus* (Douglas, 1829) - SW Washington to C California, W USA; also (probably introduced) Vancouver I. SW Canada, and W Washington, NW USA.
- O. p. plumiferus* (Gould, 1938) - S Washington to W Nevada and NE & NC California, W USA.
- O. p. russelli* Miller, 1946 - S California, W USA.
- O. p. eremophila* van Rossem, 1937 - S & WC California and SW Nevada, W USA, to extreme N Baja California, NW Mexico.
- O. p. confinis* Anthony, 1889 - N Baja California, Mexico.

Introduced locally in W Idaho, NW USA, where may be native too.



Descriptive notes. 26-28 cm; 200-290 g, with sexes apparently similar. Largest quail of North America. Long black sword-shaped crest highly distinctive. White eyeline continuing onto throat; chin and throat cinnamon. Overall coloration dark blue-grey; belly chestnut with white streaks on flanks; flight-feathers with white margin. Bill black, legs brown. Female similar, with smaller crest. Immature has buff-tipped greater primary coverts. Races separated on coloration, mainly of back and breast.

Habitat. Variable, depending on population; mixed evergreen forest and chaparral; brushy oak and manzanita; forest edge; brushy thick-

ets; and farms. During summer occurs at 500-3000 m, generally lower during winter. Found at higher altitude and on steeper slopes than sympatric populations of *Callipepla californica*.

Food and Feeding. Mainly seeds and bulbs, but also fruits, flowers and green herbage. Most important plant items in California include *Lithophragma*, *Quercus*, *Stellaria*, *Erodium*, *Trifolium* and *Rhus*. Few arthropods taken even by young chicks. Foraging methods recorded include scratching in litter, digging, jumping, acorn shelling and tree climbing. Standing water required.

Breeding. Mar-Jul, occurring earlier in S, later in N; peak hatching May-Jun. Nests located under branches or shrubs, close to water. Clutch size 9-10; Eggs pale reddish buff, averaging 34.5 x 26.5 mm.

Incubation 21-25 days; carried out by female, but some evidence of male assistance. Brood may be raised by either adult of pair or by both; no evidence to date of any birds laying second clutch.

Movements. Less sedentary than other related species; evidence of altitudinal migrations of over 50 km in some populations. Coveys probably comprise family groups; normally 5-9 birds, but up to 20. **Status and Conservation.** Not globally threatened. Mace-Lande: Safe. Overall population levels stable, probably numbering over 1,000,000 birds. Important gamebird in W USA: widespread local declines and extinctions in NE portion of range, e.g. only three small populations left in Idaho. In areas with population declines, major threats include construction of dams and impoundments, agricultural conversion and grazing. In Mexico, threatened by overgrazing.

Bibliography. Alderton (1992), Blake (1953), Block *et al.* (1984, 1991), Brennan (1985, 1990, 1991a), Brennan & Block (1985, 1986), Brennan *et al.* (1985, 1986, 1987), Browning (1977), Church & Dailey (1993), Edwards (1989), Grinnell *et al.* (1918), Gutiérrez (1975, 1980), Gutiérrez *et al.* (1983), Johnsgard (1973, 1975), Leopold (1959), Lever (1987), McLean (1930), Ormiston (1966), Pine (1981), Ridgway & Friedmann (1946), van Rossem (1937), Terres (1980), Yocom & Harris (1953).

Genus *CALLIPEPLA* Wagler, 1832

5. Scaled Quail

Callipepla squamata

French: Colin écaillé German: Schuppenwachtel Spanish: Colín Escamado
Other common names: Blue Quail

Taxonomy. *Ortyx squamatus* Vigors, 1830, interior of Mexico.

Sometimes considered conspecific with *C. douglasii*. Four subspecies recognized.

Subspecies and Distribution.

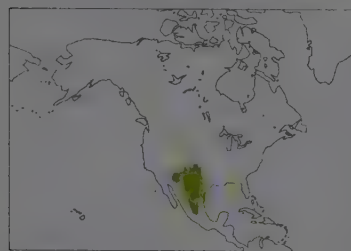
C. s. hargrivi Rea, 1973 - SE Colorado, SW Kansas, N New Mexico, W Oklahoma and NW Texas, WC USA.

C. s. pallida Brewster, 1881 - S Arizona, S New Mexico and W Texas, SC USA, to N Chihuahua and N Sonora, NW Mexico.

C. s. squamata (Vigors, 1830) - N Sonora and N Tamaulipas S to Valley of Mexico, Mexico.

C. s. castanogastris Brewster, 1883 - S Texas, S USA, and NE Mexico.

Introduced to C Washington and Nevada, W USA.



Descriptive notes. 22-29 cm; 151-202 g, with sexes apparently similar. Distinctive short, bushy crest is mainly buff to white, with white tip (cottontop). Overall coloration blue-grey. Back, breast and belly blue-grey, fading to buff below, with black feather tips, producing scaly appearance; buff or white streaks on folded wing and flanks. Bill black, legs greyish black. Female has smaller crest; brown streaks on face and throat. Immature has greater primary coverts tipped with buff. Races separated in tone of grey on upperparts, darker in *castanogastris*, paler in *pallida*; also in colour of belly, chestnut in *castanogastris*.

Habitat. Desert scrub and grasslands; prefers some variation, and avoids uninterrupted stretches of grassland. Often occurs where standing water available.

Food and Feeding. Takes wide variety of food types, especially seeds, insects and green herbage. In Texas, commonest items were seeds of honey mesquite, sunflowers, common Russian thistle and sorghum, herbage of lanceleaf krameria and milkvetch, and insects such as grasshoppers and beetles. In Mexico, takes seeds of *Bidens*, corn cockle, *Croton*, foxtail, *Panicum* and Johnson grass. Fruits of *Atriplex* and *Mahonia* also eaten.

Breeding. Jun-Oct (rainy season). Nests located under shrubby vegetation e.g. soapweed or sand sage, and other grasses or forbs. Clutch size averages 12-7-14 in USA; average 12 eggs (9-16) in Mexico. Eggs dull white with brown or white speckling, averaging 32.5 x 25.0 mm. Incubation 21-23 days, by female; assistance by male extremely rare. Double-clutching reported. Average brood size in USA 7-8-11-5.

Movements. Sedentary; birds generally move about less than 2 km, although some movements of over 100 km reported. Moves about in coveys, normally of 10-40 birds, but sometimes up to 200. Home range of 10-34 ha.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Total population probably numbers over 1,000,000 birds. Important gamebird in SW USA; has declined rather dramatically in USA since 1960. Mesquite control detrimental to populations. Has benefited from clearing of pine and oak forest, and also from overgrazing in past.

Bibliography. Anderson (1978), Ault & Storer (1983), Blake (1953), Brown, D.E. (1989), Cain *et al.* (1987), Campbell, D.K. *et al.* (1973), Campbell, H. (1968), Campbell, H. & Harris (1965), Campbell-Kissok *et al.* (1985), Church & Dailey (1993), Davis *et al.* (1975), Dixon (1959), Edwards (1989), Pigge (1946), Fleming & Baker (1963), Hammenquist-Wilson *et al.* (1987), Hoffman (1965), Johnsgard (1973, 1975), Kelso (1937), Lehmann (1984), Lehmann & Ward (1941), Leopold (1959), Ligon (1961), McCabe (1954), Medina (1988), Rea (1973), Ridgway & Friedmann (1946), van Rossem (1945), Russell (1932), Saunders & Parrish (1987), Schemnitz (1959, 1961, 1964), Smith & Cain (1984), Storer (1984), Terres (1980), Urban (1959), Wallino (1956a, 1956b, 1957).

6. Elegant Quail

Callipepla douglasii

French: Colin élégant German: Douglaswachtel Spanish: Colín Elegante
Other common names: Douglas Quail

Taxonomy. *Ortyx douglasii* Vigors, 1829, Mazatlan, Sonora, Mexico.

Often placed in *Lophortyx*. Sometimes considered conspecific with *C. squamata*. Some debate over status and relationship of races *douglasii* and *impedita*; validity of *languens* also questionable. Five subspecies normally recognized.

Subspecies and Distribution.

C. d. bensoni Ridgway, 1887 - Sonora, NW Mexico.

C. d. languens (Friedmann, 1943) - N Chihuahua, NW Mexico.

C. d. douglasii (Vigors, 1829) - S Sonora, Sinaloa, NW Durango and N Nayarit, W Mexico.

C. d. impedita (Friedmann, 1943) - C & S Nayarit, W Mexico.

C. d. teres (Friedmann, 1943) - NW Jalisco, WC Mexico.

Descriptive notes. 21-24 cm, 160-190 g. Males slightly larger. Long vertical crest is orange buff in male. Overall coloration blue-grey. Crown, sides of head and neck and throat grey with black streaks. Lower breast and belly grey with rows of white spots with black margins. Bill and legs black. Female

Family ODONTOPHORIDAE (NEW WORLD QUAILS) SPECIES ACCOUNTS



averaging 33.9 x 23.9 mm. Incubation 22-23 days.

Movements. Presumably sedentary. Coveys of 6-20 birds observed.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Status not well known; total population might number c. 50,000-100,000 birds. Reported to be common in several areas in 1960's. Human activity has apparently been responsible for population increases in some areas.

Bibliography. Alden (1969), Alderton (1992), Blake (1953), Davis (1972), Edwards (1989), Escalante (1988), Johnsgard (1973, 1988), Leopold (1959), Miller (1905), Raethel (1988), Ridgway & Friedmann (1946), Robbins (1981), van Rossem (1945).

7. California Quail

Callipepla californica

French: Colin de Californie German: Schopf wachtel Spanish: Colín de California
Other common names: Valley Quail

Taxonomy. *Tetrao californicus* Shaw, 1798, Monterey, California, USA.

Often placed in *Lophortyx*. Sometimes considered conspecific with *C. gambelii*, with which forms superspecies. Eight subspecies recognized.

Subspecies and Distribution.

C. c. californica (Shaw, 1798) - N Oregon and W Nevada, NW USA, S to Los Coronados Is, Baja California, NW Mexico; also (probably introduced) from S British Columbia, SW Canada, SE to Colorado, WC USA.

C. c. orecta (Oberholser, 1932) - SE Oregon and extreme NE California, W USA.

C. c. brunnescens (Ridgway, 1884) - coastal N California to SC California, W USA; also (probably introduced) Vancouver I, Canada.

C. c. catalinensis (Grinnell, 1906) - Santa Catalina I, off SW California, W USA; also (probably introduced) nearby Santa Rosa and Santa Cruz Is.

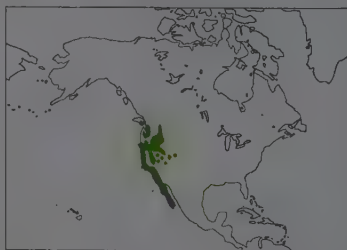
C. c. canfieldae (van Rossem, 1939) - EC California, W USA.

C. c. plumbea (Grinnell, 1926) - S California, W USA, to N Baja California, NW Mexico.

C. c. decolorata (van Rossem, 1946) - C & S Baja California, NW Mexico.

C. c. achruster (Peters, 1923) - extreme S Baja California, W Mexico.

Introduced to Chile, Argentina, New Zealand, King I (Australia) and Hawaii.



Descriptive notes. 23-27 cm; male 176 g, female 162 g. Long black teardrop-shaped crest. Distinctive black and white pattern on face and throat separates from all except *C. gambelii*; differs from that species in having belly buff with black and brown feather tips, giving scaly pattern. Overall coloration blue-grey; crown chestnut; white streaking on flanks. Bill black, legs grey. Female has smaller crest; head and throat greyish with dark streaks. Immature has buff-tipped greater primary coverts. Races separated on general coloration, especially different tones of greyish or brownish back; also to some extent on size.

Habitat. Very diverse habitats, depending on area, and including brushland, chaparral, desert, evergreen forest, forest edge, grassland and agricultural land.

Food and Feeding. Mainly seeds and bulbs of *Lupinus*, *Lotus*, *Erodium*, *Trifolium*, *Medicago*, *Phoradendron*, *Salsola kali*, *Quercus*, *Hypochoeris* and barley; also takes green herbage. Scratches in litter for seeds; also plucks leaves from growing vegetation. Standing water needed.

Breeding. Early Apr (in S) or May-Jun (in N) to Jul-Aug. Nest is depression in ground lined with grass. Clutch size 13-17 (up to 28). Eggs creamy white with light brown blotches, averaging 31.6 x 24.1 mm. Incubation 22-23 days by female; male assists with brood rearing. Double-clutching reported. Low nest success, often of under 20%.

Movements. Sedentary; maximum movements recorded less than 27 km. Typically circulates in coveys of 25-40 birds, but up to 1000 seen together. Home range of 2-18 ha; smaller in summer, larger in winter.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Important gamebird in W USA, with over 2,000,000 harvested per year; however, has declined rather dramatically in USA since 1960. Grazing can have detrimental effects, but undergrazing in mesic areas also shown to have a negative impact on populations.

Bibliography. Anthony (1970), Barclay & Bergerud (1975), Bartholomew & Dawson (1958), Bartholomew & MacMillan (1961), Blake (1953), Blakely *et al.* (1990), Blus *et al.* (1985), Brown & Gutiérrez (1980), Chandler (1970), Church & Dailey (1993), Crawford (1978b), Crispens *et al.* (1960), Duncan (1968), Edwards (1989), Emilen (1939, 1940), Fjeldså & Krabbe (1990), Francis (1965, 1967, 1970), Genelly (1955), Glading (1938a, 1938b, 1941), Glading *et al.* (1945), Gullion & Christensen (1967), Gutiérrez (1980), Gutiérrez *et al.* (1983), Hill & Wiggins (1948), Howard & Emilen (1942), Johnsgard (1973), Johnson (1965), Jones (1969), Kilbride *et al.* (1992), Leopold (1959, 1977), Lever (1987), Lewin (1963, 1965), Linsdale (1936), McMillan (1964), Oates & Crawford (1983), Raitt (1960, 1961), Raitt & Genelly (1964), Shields & Duncan (1966), Stinnett & Klebenow (1986), Sumner (1935), Terres (1980), Williams, G.R. (1952), Williams, H.W. (1969), Zink *et al.* (1987).

8. Gambel's Quail

Callipepla gambelii

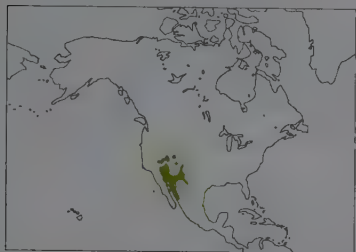
French: Colin de Gambel German: Helm wachtel Spanish: Colín de Gambel
Other common names: Desert Quail

Taxonomy. *Lophortyx gambelii* Gambel, 1843, west of California = south Nevada, USA.

Often placed in *Lophortyx*. Sometimes considered conspecific with *C. californica*, with which forms superspecies. Seven subspecies recognized.

Subspecies and Distribution.

C. g. gambeli (Gambel, 1843) - S Utah and Nevada, W USA, S to Baja California, NW Mexico.
C. g. sana (Mearns, 1914) - W Colorado, WC USA.
C. g. ignoscens (Friedmann, 1943) - S New Mexico and extreme W Texas, SC USA.
C. g. pembertonii (van Rossem, 1932) - Tiburon I, in Gulf of California, NW Mexico.
C. g. fulvipes Nelson, 1899 - NC to SW Sonora, NW Mexico; possibly also SE Arizona and SW New Mexico, SW USA.
C. g. stephensi (Phillips, 1959) - S Sonora, NW Mexico.
C. g. friedmanni (Moore, 1947) - coastal and NW Sinaloa, NW Mexico.
Introduced (*gambeli*) to Idaho, NW USA.



Descriptive notes. 23-27 cm; male 161 g, female 156 g. Long black teardrop-shaped crest. Distinctive black and white pattern on face and throat separates from all except *C. californica*; differs from that species in having belly buff with black median patch. Overall coloration blue-grey; crown reddish brown; brown and white streaking on flanks. Bill black, legs grey. Female has smaller crest; head and throat greyish with dark streaks. Immature has buff-tipped greater primary coverts. Races separated on tone of grey on upperparts, and of buff on belly.

Habitat. Occurs in three types of desert: low warm desert valleys dominated by mesquite

(*Prosopis*); upland warm deserts dominated by cat's claw (*Acacia*), yucca (*Yucca*), and prickly-pear cactus (*Opuntia*); and cool desert dominated by sagebrush (*Artemisia*). Also frequents irrigated agricultural habitats.

Food and Feeding. Takes wide variety of food types: mainly flowers and seeds; generally few insects, although more eaten by chicks. Plants most commonly recorded are deerweed (*Lotus*), filaree (*Erodium*), mesquite, and alfalfa (*Medicago*). Water apparently needed when succulent plants are not available.

Breeding. Late Apr-Aug. Nest is shallow depression concealed in grass or bush. Clutch size 12-14 (up to 19). Eggs white with purplish brown splotches, averaging 32.0 x 24.0 mm. Incubation 23 days, by female; male assists in rearing of brood. Double-brooding reported.

Movements. Sedentary; maximum movement recorded was under 16 km. Coveys average 12.5 birds, but up to 40. Home range c. 7-40 ha.

Status and Conservation. Not globally threatened. Mace-Land: Safe. Total population numbers over 1,000,000 birds. Populations in USA stable since 1960's. Important gamebird in SW USA. Tolerant of conversion of desert to cropland, although heavy grazing can reduce populations. Status in Mexico poorly known, but probably secure.

Bibliography. Alden (1969), Beck *et al.* (1973), Blake (1953), Brown, D.E. (1989), Campbell (1957), Church & Dailey (1993), Edwards (1989), Ellis & Stokes (1966), Goldstein (1983, 1984), Gorsuch (1934), Gullion (1960, 1962), Hungerford (1962, 1964), Johnson (1973, 1975), Leopold (1959), Lever (1987), Ligon (1961), Phillips (1958), Pielka (1948), Raitt & Ohmart (1966, 1968), Ridgway & Friedmann (1946), van Rossem (1945), Sutton & Phillips (1942), Swank & Gallizioli (1954), Terres (1980), Vorhies (1928).

Genus *PHILORTYX* Gould, 1846

9. Barred Quail

Philortyx fasciatus

French: Colin barré

German: Bindenwachtel

Spanish: Colín Bandeado

Other common names: Banded Quail

Taxonomy. *Ortyx fasciatus* Gould, 1844, California; error, Mexico. Monotypic.

Distribution. SW Jalisco to SE Guerrero, Morelos and Puebla, WC Mexico.



Descriptive notes. 18-21 cm; 115-160 g, with male averaging 130 g, female 126 g. Breast and belly white with black barring; overall coloration greyish brown to grey; head greyish brown, with white chin and throat. Straight black and brown crest, with rufous-tipped feathers. Bill black, legs brown. Female has shorter crest. Immature has black feathering on face, chin and throat.

Habitat. Arid and semi-arid tropical scrub, weed-bordered agricultural land, and overgrown pastures, from sea-level to over 1500 m. More common at lower elevations.

Food and Feeding. Mainly seeds of *Desmodium*

and *Crotalaria*; also seeds of sunflower, thistles, corn cockle, *Croton* and cultivated beans and sesame. In addition, takes some insects, e.g. leaf beetles and larvae of Lepidoptera. Drinks water during dry season.

Breeding. Nesting in Aug and Sept. In captive birds; nest made of grass with partial roof; average clutch size 5.5 (3-7); eggs laid at intervals of 2 days; incubation 22-6 days (21-23). Eggs white, averaging 30.2 x 23.7 mm.

Movements. Sedentary. Often occurs in coveys of 5-20 birds; overall average covey size of 12 birds, but only 5.8 in Jun; in W Mexico, coveys of 10-40 in Guerrero, and 10-20 in Jalisco.

Status and Conservation. Not globally threatened. Mace-Land: Safe. Total population may number under 100,000 birds, but thought to be stable. Limited range; very little information available. Potential threats include overgrazing and agricultural intensification. Hunting occurs in some areas.

Bibliography. Alderton (1992), Binford (1989), Blake (1953, 1977), Blake & Hanson (1942), Davis, L.I. (1972), Davis, W.B. (1944), Edwards (1989), Johnson (1973, 1988), Leopold (1959), Ridgway & Friedmann (1946), Schaldach (1963), Zimmerman & Harry (1951).

Genus *COLINUS* Goldfuss, 1820

10. Northern Bobwhite

Colinus virginianus

French: Colin de Virginie

German: Virginiawachtel

Spanish: Colín de Virginia

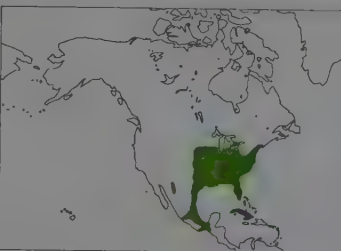
Other common names: Common Bobwhite, Bobwhite; Rufous-bellied Bobwhite (*pectoralis*); Masked Bobwhite (*ridgwayi*); Black-headed Bobwhite (*atriceps*)

Taxonomy. *Tetrao virginianus* Linnaeus, 1758, America = South Carolina, USA.

Sometimes considered conspecific with *C. nigrogularis*. Several races have at times been considered full species. Validity of race *nelsoni* questionable. Twenty-two subspecies recognized.

Subspecies and Distribution.

C. v. marilandicus (Linnaeus, 1758) - SE Maine to C Virginia, NE USA.
C. v. virginianus (Linnaeus, 1758) - Virginia to N Florida and W to Alabama, E USA.
C. v. floridanus (Coe, 1872) - peninsular Florida, E USA.
C. v. cubanensis (G. R. Gray, 1846) - Cuba and I of Pines.
C. v. mexicanus (Linnaeus, 1766) - E USA; W of *marilandicus* and E of *taylori*.
C. v. taylori Lincoln, 1915 - South Dakota to N Texas to W Missouri, C USA.
C. v. texanus (Lawrence, 1853) - SW Texas, USA, and Coahuila, Nuevo Leon and Tamaulipas, NE Mexico.
C. v. ridgwayi Brewster, 1885 - NC Sonora, Mexico; reintroduced to SE Arizona, SW USA, where extirpated in past.
C. v. maculatus Nelson, 1899 - C Tamaulipas to N Veracruz and SE San Luis Potosí, NE Mexico.
C. v. aridus Aldrich, 1942 - C Tamaulipas to SE San Luis Potosí, NE Mexico.
C. v. graysoni (Lawrence, 1867) - SE Nayarit and S Jalisco to Morelos, S Hidalgo and SC San Luis Potosí, C Mexico.
C. v. nigripictus Nelson, 1897 - Puebla, Morelos and México (state), Mexico.
C. v. pectoralis (Gould, 1843) - E slope of mountains of C Veracruz, E Mexico.
C. v. godmani Nelson, 1897 - lowland Veracruz, E Mexico.
C. v. minor Nelson, 1901 - NE Chiapas and adjacent Tabasco, S Mexico.
C. v. atriceps (Ogilvie-Grant, 1893) - extreme W Oaxaca, S Mexico.
C. v. thayeri Bangs & Peters, 1928 - NE Oaxaca, S Mexico.
C. v. harrisoni Orr & Webster, 1968 - SW Oaxaca, S Mexico.
C. v. coyoclos (P. L. S. Müller, 1776) - coast of E Oaxaca and N Chiapas, S Mexico.
C. v. nelsoni Brodtkorb, 1942 - S Chiapas, Mexico.
C. v. salvini Nelson, 1897 - coast of S Chiapas, Mexico.
C. v. insignis Nelson, 1897 - S Chiapas, S Mexico, and Huehuetenango, W Guatemala.
Introduced to British Columbia (Canada), Puerto Rico, Hawaii, New Zealand and West Indies; also (*taylori*) to Washington, Oregon and Idaho, NW USA; may be introduced to I of Pines and Cuba, although this population usually awarded subspecific status.



Descriptive notes. 20-25 cm. Size increases from S to N; average 129 g (Chiapas); 159 g (San Luis Potosí); male 173 g, female 170 g (E USA). Lacks prominent crest. Extremely variable, both within and among races, with greatest variation on head and underparts; overall coloration involves combinations of grey, brown and white. Several races have white supercilium and black or brown eyeline, combined with white moustachial streak or all white throat; others have chin and throat blackish, with breast often blackish or brownish. Bill black, legs horn-coloured. Female lacks striking black and white facial patterns; head and

throat mostly buff. Immature has greater primary coverts tipped buff. Races separated mainly on plumage, but also on size: pattern of white eyestripe bordered by black and white throat found in those of USA and some of Mexico.

Habitat. Varies with population; includes pine woodlands, woodland edge, shrubs, agricultural fields, pastures, rangeland and fallow fields.

Food and Feeding. In Mexico, primarily seeds of sunflowers, foxtails, panic grass, thistles, and *Desmodium*; oak acorns, and cultivated frijoles, corn, wheat and tomatoes. In Alabama, S USA, most important food is legume seeds. In several areas dominated by grassland, diet includes *Croton*, *Sesbania*, *Panicum*, *Ambrosia* and *Helianthus*. In agricultural areas, diet varies according to major crops, including corn, sorghum, oats, soybeans and wheat; also oak acorns. Insects important during summer.

Breeding. Variable in USA, with peak in Apr-Jun, earlier in S, later in N; Apr-Jun in Mexico, where possibly later in Oaxaca, to coincide with rainy season. Nest constructed in depression on ground and lined with dead vegetation; standing vegetation usually covers nest from above. Clutch size averages 12.5-14.4 eggs (10-15); clutch of 8 eggs in Oaxaca, S Mexico; generally fewer eggs in second clutches. Incubation 23 days. Nest success 20-40%. Eggs dull white, but can be stained; average 30 x 24 mm.

Movements. Sedentary, except during autumn dispersal. Normally forms coveys; on average of 12 birds (8-20) in Mexico; average 13.8 or 14.3 in USA, but up to 28 birds. Home range of as much as 25 ha, but usually under 10 ha.

Status and Conservation. Not globally threatened. Mace-Land: Safe. In USA, over 20,000,000 individuals per year killed by hunters. Populations in parts of the USA intensively studied and managed; however, populations in many areas declining, and contraction of range in NE USA; severe declines in traditional areas of SE USA. Mexican populations not well known and some subspecies could be threatened. Race *ridgwayi* considered endangered in USA, and subject to intensive restoration effort in Arizona; small population in Sonora, NW Mexico, could be threatened. Major threat in Mexico is overgrazing. Other potential threats include pesticides, in agricultural areas, and hunting. Subspecies *ridgwayi* on CITES I.

Bibliography. Aldrich (1946), Alvarez del Toro (1952), Bauer (1985), Binford (1989), Blake (1953, 1977), Brennan (1991b), Briggs (1954), Brodtkorb (1943), Brown & Ellis (1977), Brown & Gutiérrez (1980), Burger (1993), Burger *et al.* (1990), Cain *et al.* (1982), Carriannell Kissack *et al.* (1984, 1985), Church & Dailey (1993), Church & Taylor (1992), Coggins (1986), Davis (1972), DeMaso *et al.* (1992), Dimmick (1975), Droege & Sauer (1990), Ellis, D.H. & Serafin (1977), Ellis, D.H. *et al.* (1978), Ellis, J.A. *et al.* (1969), Ellsworth & Roseberry (1988), Ellsworth *et al.* (1989), Escalante (1988), Gilpin (1982), Gilpin & Hungerford (1977), Gissom (1932), Guthery (1986), Guthery & Koerth (1992), Guthery *et al.* (1988), Gutiérrez *et al.* (1983), Hammerquist-Wilson & Crawford (1987), Johnson & Guthery (1988), Kahal & Thompson (1963), Kiel (1976), Klimstra & Roseberry (1975), Koerth & Guthery (1991), Landers & Johnson (1976), Landers & Mueller (1989), Lehmann (1953, 1984), Lever (1987), Ligon (1952, 1961), Lowery & Dalquest (1951), Lyon (1962), Marsden & Baskett (1958), McInteer (1986), McRae & Dimmick (1982), Morrison & Lewis (1972), Murphy & Baskett (1952), Murray & Frye (1957), O'Brien *et al.* (1985), Pappe & Sweeney (1944), Pringle (1948), Pulliam, Moore *et al.* (1989), Pollock, Wuerstein *et al.* (1989), Rice *et al.* (1993), Robel & Arruda (1986), Robel & Fretwell (1970), Roseberry & Klimstra (1984, 1993), Roseberry (1969), van Rossem (1945), Rowley, 1984, Schmitt (1964), Schiesskey *et al.* (1982), Scott, T.G. (1985), Sermon & Speake (1987), Simms (1989), Skewes *et al.* (1988), Solomon & Robel (1980), Speers *et al.* (1993), Spofford *et al.* (1990), Stanger *et al.* (1977), Stanger (1931), Stokes (1967), Terres (1980), Tomlinson (1972a, 1972b, 1975, 1984), Urban (1959), Weimore (1927), White *et al.* (1990), Wood *et al.* (1986).



11. Black-throated Bobwhite

Colinus nigrogularis

French: Colin à gorge noire German: Schwarzkehlwachtel Spanish: Colín Gorginegro
Other common names: Yucatan Bobwhite

Taxonomy. *Ortyx nigrogularis* Gould, 1843, Mexico = Belize.

Possibly conspecific with *C. virginianus*. Four subspecies recognized.

Subspecies and Distribution.

C. n. persicus Van Tyne & Trautman, 1941 - Progreso area of Yucatán, SE Mexico.

C. n. caboti Van Tyne & Trautman, 1941 - N Campeche, Yucatán (except Progreso area) and N Quintana Roo, SE Mexico.

C. n. nigrogularis (Gould, 1843) - Belize and N Guatemala.

C. n. segoviensis Ridgway, 1888 - E Honduras and NE Nicaragua.



Descriptive notes. 18-21.5 cm; 126-144 g, with sexes apparently similar. Distinctive face pattern separates from congeners. Forehead, sides of head, and throat black; small crest and crown chestnut; white stripes above and below eye. Overall coloration is mixture of rufous, white and black. Back of neck and upper back cinnamon with rows of buff and white spots; back chestnut with grey feather margins, rump olive brown and grey, scapulars and upperwing-coverts cinnamon with grey, chestnut and black spots. Breast and belly white with rows of black "V"s; flanks white with brown and black feather margins.

Bill black and legs brown or slate blue. Female has crown buff with rows of small black spots; sides of head and neck buff fading to whitish on throat; back and rump mottled olive brown with cinnamon and black "V"s; breast and belly light grey with small black "V"s becoming larger on belly. Immature has buff-tipped greater primary coverts. Races separated on size, plumage tone and extent of white spotting.

Habitat. Brush, woodland edge, forest openings with weeds, pine savannas and agricultural land. Apparently best habitat in areas where henequin is planted. During dry seasons often associated with standing water.

Food and Feeding. Known to take seeds, including *Desmodium*.

Breeding. Laying Apr-Aug or later; most reports of adults in breeding condition or clutches during Jun-Aug; newly-hatched chicks in Nov. Nest in hollow on ground lined with grass. Eggs pale buff to white, sometimes with small dark spots; size averages 30.5 x 22.7 mm.

Movements. Sedentary. Coveys of 12-20 birds reported.

Status and Conservation. Not globally threatened. Mace-Landé: Safe. Status not well known; total population may number 100,000-1,000,000 birds, and thought to be stable. Reported to be common in many areas, and has benefited from clearing of forest for agricultural land. However, population surveys and research on biology of species still needed.

Bibliography. Alderton (1992), Blake (1953, 1977), Davis (1972), Edwards (1989), Howell (1971), Johnsgard (1973, 1988), Klaas (1968), Land (1970), Lee (1966), Leopold (1959), Monroe (1968), Nelson (1932), Paynter (1955), Ridgway & Friedmann (1946), Russell (1964), Saunders *et al.* (1950), Smith (1966), Stone (1890), Traylor (1941), Van Tyne (1935), Van Tyne & Trautman 1941).

12. Spot-bellied Bobwhite

Colinus leucopogon

French: Colin à face blanche German: Fleckenwachtel Spanish: Colín Gorgiblanco
Other common names: White-breasted Bobwhite (*hypoleucus*); Sclater's Bobwhite (*sclateri*); Dickey's Bobwhite (*dickeyi*)

Taxonomy. *Ortyx leucopogon* Lesson, 1842, San Carlos = la Unión, El Salvador.

Often considered conspecific with *C. cristatus*. Several races have at times been considered full species. Race *nicaraguae* no longer considered valid. Six subspecies recognized.

Subspecies and Distribution.

C. l. incanus Friedmann, 1944 - S Guatemala.

C. l. hypoleucus (Gould, 1860) - W El Salvador and adjacent Guatemala.

C. l. leucopogon (Lesson, 1842) - SE El Salvador and W Honduras.

C. l. leylandi (Moore, 1859) - NW Honduras.

C. l. sclateri (Bonaparte, 1856) - SW & C Honduras to NW Nicaragua.

C. l. dickeyi Conover, 1932 - NW & C Costa Rica.



Descriptive notes. 19-23 cm; estimated weight of male 144 g, of female 115 g. Small crest olive brown with buff feather margins. Overall coloration mottled grey and dusky, also white. Distinctive face patterns separate from congeners. Plumage very variable, with head and underparts of two types: northern (*leucopogon* and N), with forehead, supercilium and throat, and in some races breast and belly, white; and southern (*leylandi* and S), with forehead black or brown, supercilium white or buff, throat brown with black border or black with white or buff border, hindneck spotted with black, and breast and belly reddish brown. Back and rump mottled grey and brown with black vermiculations. Bill black and legs bluish horn. Female similar, but throat buff and spotted with black; breast and belly buff with black and tan streaks or bars. Immature similar to female. Races separated on plumage colours, especially of head and underparts.

Bill black and legs bluish horn. Female similar, but throat buff and spotted with black; breast and belly buff with black and tan streaks or bars. Immature similar to female. Races separated on plumage colours, especially of head and underparts.

Habitat. Arid lower tropical zone, including open pine forest, grassland, brush, woodland edges and agricultural land, at altitudes under 1800 m.

Food and Feeding. Small seeds, especially sacaton bunch grass and small buds in El Salvador. Seeds, fruits and insects in Costa Rica; sometimes feeds on beans and rice crops.

Breeding. Pairing in Apr, nesting generally May-Sept, although often later in El Salvador. Nests on ground in bowl of herbage under thick vegetation cover. Clutch size of 10 eggs in Costa Rica. Eggs white, averaging 31.1 x 25 mm.

Movements. Presumably sedentary. One covey of 8 birds observed; coveys of 3-15 birds in Costa Rica.

Status and Conservation. Not globally threatened. Mace-Landé: Safe. Status not well known; total population might number under 500,000 birds, but thought to be relatively stable. Reported common in many parts of range and range expansion reported. This species has benefited from activities of humans, especially through clear-cutting of forest and development of agriculture. Nevertheless, population surveys and research needed.

Bibliography. Alderton (1992), Blake (1977), Dickey & van Rossem (1938), Griscom (1932), Johnsgard (1988), Land (1970), Monroe (1968), Ridgway & Friedmann (1946), Saunders *et al.* (1950), Schonwetter (1967), Shud (1964), Stiles & Skutch (1989), Stone (1932), Wetmore (1965).

13. Crested Bobwhite

Colinus cristatus

French: Colin huppé German: Haubenwachtel Spanish: Colín Crestudo

Taxonomy. *Tetrao cristatus* Linnaeus, 1766, Mexico, Guiana = Curaçao.

Often considered conspecific with *C. leucopogon*. Race *leucotis* has been considered distinct species. Validity of several Venezuelan races possibly in question, due to overlapping distribution and lack of barriers. Nominat race sometimes subdivided, with recognition of race *continentis*. Type locality of species questionable. Thirteen subspecies recognized.

Subspecies and Distribution.

C. c. mariae Wetmore, 1962 - Chiriquí area, Panama.

C. c. panamensis Dickey & van Rossem, 1930 - Pacific slope of W Panama.

C. c. decoratus (Todd, 1917) - Caribbean coast of Colombia.

C. c. cristatus (Linnaeus, 1766) - NE Colombia and Barinas, NW Venezuela, in and near Guajira Peninsula; Curaçao and Aruba, where possibly introduced.

C. c. littoralis (Todd, 1917) - N base of Santa Marta Mts, NE Colombia.

C. c. badius Conover, 1938 - Cauca Valley to W slope of Western Andes, W Colombia.

C. c. leucotis (Gould, 1844) - upper and middle sections of Magdalena Valley, and middle Sinú Valley, C Colombia.

C. c. bogotensis Dugand, 1943 - E Andes in Boyacá and Cundinamarca, NC Colombia.

C. c. parvircristatus (Gould, 1843) - C Colombia (E slope of E Andes in Boyacá and Cundinamarca, through Meta and llanos) to SC Venezuela (NW Bolívar and N Amazonas).

C. c. horvathi (Madarász, 1904) - Andes of Mérida, NW Venezuela.

C. c. cristatus (Gilliland, 1940 - Portuguesa and Barinas, WC Venezuela.

C. c. moqueyensis (Hartert, 1894) - Sucre, N Monagas and N Anzoátegui, NE Venezuela.

C. c. sonnini (Temminck, 1815) - Carabobo and Caracas, NC Venezuela, S through Orinoco Basin and Guianas to N Brazil.

Introduced (*sonnini*) to Mustique, Grenadines, St Thomas and Virgin Is.



Descriptive notes. 18-21.5 cm; male 132-153 g, female 131-141 g (Surinam). Prominent crest separates from congeners, although size variable with race; crown and crest white to buff. Overall coloration mottled grey, brown and black. Side of head, throat and eyeline rufous; hindneck and ring around throat white with black and cinnamon spots; back and rump mottled grey and brown; wing feathers with buff margins; breast and belly cinnamon with black, white and buff spots. Bill black, legs horn. Female has shorter, darker brown crest; plumage mottled brown and buff, with black and brown streaks. Immature spotted

brown and white on breast and belly; greater primary coverts tipped buff. Races differ mainly in tone of plumage and length of crest; also some variation in size.

Habitat. Arid lowlands, and locally into subtropical zone, using thickets, woodland edges, savanna, roadsides and embankments; also agricultural fields (of rice and sugarcane, or pastures). Generally under 1500 m, but up to 3200 m in Colombia.

Food and Feeding. Mainly seeds, but also insects during wet season in Venezuela. Most important plants include *Euphorbia*, *Hyptis*, Mimosaceae, *Phaseolus*, *Brachiaria*, *Digitaria*, *Paspalum* and *Hachelochloa*; also feeds on sesame and sorghum. In Brazil, adapted to life alongside humans and will come to houses to feed.

Breeding. Apr/May-Oct/Nov, corresponding to wet season in Venezuela; adults in breeding condition Jul-Sept in Colombia, where chick seen in Feb. 8-16 eggs in Venezuela; up to 15 eggs in Colombia. Eggs cream-coloured, often heavily spotted or blotched with brown; size averages 40 x 30 mm. Incubation 22-23 days.

Movements. Presumably sedentary. Pairs and coveys up to 12 birds in Surinam, and of 10-15 birds in Venezuela.

Status and Conservation. Not globally threatened. Mace-Landé: Safe. Status not well known; total population might number over 1,000,000 birds. Apparently common in many areas, and range expansion reported. Very common in some major river valleys of Colombia. Has recently spread into lowlands of Golfo Dulce, in SW Costa Rica. However, highland races in Colombia uncommon and local. Species has generally benefited from activities of humans, especially from clear-cutting of forest and development of agriculture. Potential threats include pesticides, in agricultural areas, and hunting.

Bibliography. Blake (1977), Borrero (1972), Darlington (1931), Espinoza (1982, 1983), Fjeldså & Krabbe (1990), Gines & Alveledo (1958), Haverschmidt (1968), Hilty & Brown (1986), Johnsgard (1988), Mendez (1979), Mendoza (1982a, 1982b), Meyer de Schauensee (1964), Meyer de Schauensee & Phelps (1978), Miller (1963), Monroe (1968), Morales (1977a, 1977b, 1980), Morales & Pacheco (1976), Peters (1934), Pinto (1964), Ridgely & Gwynne (1989),

On following pages: 14. Marbled Wood-quail (*Odontophorus gujanensis*); 15. Spot-winged Wood-quail (*Odontophorus capueira*); 16. Black-eared Wood-quail (*Odontophorus melanotis*); 17. Rufous-fronted Wood-quail (*Odontophorus erythrops*); 18. Black-fronted Wood-quail (*Odontophorus atrifrons*); 19. Chestnut Wood-quail (*Odontophorus hyperythrus*); 20. Dark-backed Wood-quail (*Odontophorus melanonotus*).

Ridgway & Friedmann (1946), Ruschi (1979), Schäfer & Phelps (1954), Schönwetter (1967), Sick (1985a, 1993), Snyder (1966), Stiles & Skutch (1989), Tostain *et al.* (1992), Wetmore (1927, 1963, 1965).

Genus *ODONTOPHORUS* Vieillot, 1816

14. Marbled Wood-quail

Odontophorus gujanensis

French: Toco de Guyane German: Marmorwachtel Spanish: Corcovado Común

Taxonomy. *Tetrao gujanensis* Gmelin, 1789, Cayenne.

Eight subspecies recognized.

Subspecies and Distribution.

O. g. castigatus Bangs, 1901 - SW Costa Rica and (formerly) W Panama.

O. g. marmoratus (Gould, 1844) - E Panama to N Colombia and NW Venezuela.

O. g. gujanensis (Gmelin, 1789) - SE Venezuela, Guianas and Brazil (S to Mato Grosso) and extreme N Paraguay.

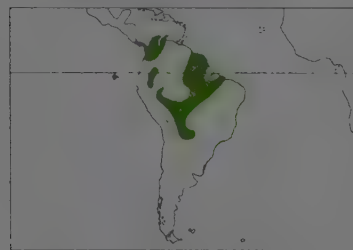
O. g. medius Chapman, 1929 - S Venezuela and NW Brazil.

O. g. buckleyi Chubb, 1919 - base of E Andes of Colombia, E Ecuador and N Peru.

O. g. rufogularis Blake, 1959 - upper reaches of R Yavari, NE Peru.

O. g. pachyrhynchus Tschudi, 1844 - E Peru and possibly also W Bolivia.

O. g. simonsi Chubb, 1919 - E Bolivia.



Descriptive notes. 23-29 cm; male 313-380 g, female 298 g. Bare eye-ring of red or orange skin distinctive. Plumage lacks any striking patterns; overall coloration brown and grey, although highly variable. Crown and crest reddish brown with dark vermiculations; sides of head and throat chestnut, rufous or grey. Back and rump brown or grey with black vermiculations; scapulars and upperwing-coverts brown or grey, with black and buff spots; breast and belly grey, brown or medially tawny, with black and white barring or spots. Bill and legs bluish black or grey. Female slightly smaller, but otherwise similar. Imma-

ture has less vermiculation and orange-red bill. Races vary somewhat in general coloration, especially of sides of head.

Habitat. Lowland tropical and subtropical forest up to 1800 m. Found on forest floor in rain forest and in old second growth.

Food and Feeding. Berries and Myriopoda (Diplopoda) in Surinam; starchy seeds and invertebrates, e.g. millipedes, ants, cockroaches, spiders and beetles, in Panama; and dried bananas and possibly insects in Costa Rica.

Breeding. Nests found in Jan, Apr and Jun; breeding female collected in Costa Rica in Aug. Duetting reported. Nests are chambered with roofs of dead vegetation, apparently placed at base of trees or amongst roots; nest 28 cm long, 13 cm wide. Clutch size of 4 eggs (2 nests); incubation 24-28 days, apparently only by female. Chicks seen with coveys of 5-6 adults. Eggs white or white with brown spots, measuring 35.0-40.5 x 26.6-28.6 mm.

Movements. Presumably sedentary. Groups of 6-8 birds, possibly referring to families.

Status and Conservation. Not globally threatened. Mace-Land: Safe. Very little information available; total population may number over 1,000,000 birds, but possibly declining. Reported to be common in Amazon region of SE Peru, but possibly uncommon elsewhere. Apparently rare to locally common in Panama, although scarce near human settlement due to hunting. Scarce in Costa Rica, except where forest is intact. Race *castigatus* probably extirpated in Panama, and found only in restricted area in Costa Rica. Major threats include deforestation and hunting; however, with extensive distribution, probably more secure than most *Odontophorus*.

Bibliography. Blake (1977), Borrero (1972), Chapman (1917, 1926), Dubs (1992), Gines & Aveledo (1958), Havensmidt (1968), Hilty & Brown (1986), Johnsgard (1979, 1988), Mendez (1979), Meyer de Schauensee (1964), Meyer de Schauensee & Phelps (1978), Miller (1963), Parker *et al.* (1982), Petrides (1942), Phelps & Phelps (1958), Pinto (1964), Remsen & Traylor (1989), Ridgely & Gwynne (1989), Ridgway & Friedmann (1946), Ruschi (1979), Sick (1985a, 1993), Skutch (1947b, 1983a), Slud (1964), Snyder (1966), Stiles & Skutch (1989), Terborgh *et al.* (1984), Tostain *et al.* (1992), Wetmore (1965).

15. Spot-winged Wood-quail

Odontophorus capueira

French: Toco uru German: Capueirawachtel Spanish: Corcovado Urú

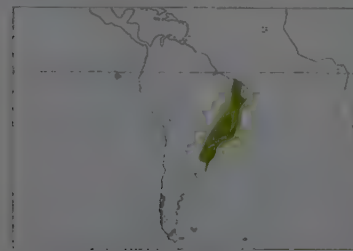
Taxonomy. *Perdix capueira* Spix, 1825, Rio de Janeiro and Minas Gerais.

Validity of race *plumbeicollis* questionable. Two subspecies recognized.

Subspecies and Distribution.

O. c. capueira (Spix, 1825) - E Brazil, E Paraguay, extreme NE Argentina.

O. c. plumbeicollis Cory, 1915 - NE Brazil



Descriptive notes. 26.5-29 cm; estimated weight of male 457 g, of female 396 g. Bright red bare eye-ring and eyelid. Sides of head, malar region, chin, throat, breast and belly plain grey; overall colour brown to grey. Crest and crown chestnut, foreneck and supercilium tawny. Back brown, with white shaft streaks; scapulars chestnut, with white shaft streaks; rump tawny with black spots. Light-feathers black with white spots. Bill black, legs grey-black. Female similar, but slightly more slender. Immature has wider shaft streaks on back; black spots on rump coarser, breast grey and belly reddish brown. Race *plumbeicollis* has

underparts paler with buff tone; supercilium and white shaft streaks on upper back are rather less prominent.

Habitat. Atlantic lowland tropical forest, including second growth forest. Found on forest floor.

Food and Feeding. Berries, especially *Phytolacca decandra*; also nuts of *Araucaria* on forest floor.

Breeding. Aug-Nov. Nests on ground, sometimes in armadillo holes. In captivity: domed nest of 40 x 50 cm was constructed; 5 eggs laid; eggs hatched after incubation period of 26-27 days. Incubation reported as 18-19 days in wild. Eggs white, often stained yellow or red; average size 40.1 x 29.1 mm.

Movements. Presumably sedentary.

Status and Conservation. Not globally threatened. Mace-Land: Safe. Very little information available; total population might number under 50,000 birds, and declining. Much reduced in interior of Brazil, and now restricted mainly to protected Atlantic coastal forests; populations of NE Brazil appear to be those most at risk. Reported common in some places where habitat protected. Major threats include deforestation and hunting. Very few recent records from Argentina and Paraguay. Extensive surveys required. Some 26 birds known to be held in captivity.

Bibliography. Alderton (1992), Blake (1977), Carvalho (1940), Dubs (1992), Flieg (1970b), Johnsgard (1979, 1988), de Magalhães (1977), de la Peña (1992), Pinto (1952a, 1964), Ruschi (1979), Sick (1985a, 1993).

16. Black-eared Wood-quail

Odontophorus melanotis

French: Toco à face noire German: Schwarzhöhrwachtel Spanish: Corcovado Orejinegro

Taxonomy. *Odontophorus melanotis* Salvin, 1865, Tucurrique, Costa Rica.

Often considered race of *O. erythrops*. Birds of Panama formerly awarded separate race, *coloratus*. Two subspecies recognized.

Subspecies and Distribution.

O. m. verecundus Peters, 1929 - Caribbean slope of Honduras.

O. m. melanotis Salvin, 1865 - SE Honduras, Nicaragua and Caribbean coast of Costa Rica and Panama.



Descriptive notes. 22-28 cm; estimated weight of male 340 g, of female 329 g. Very similar to *O. erythrops*, but lacks white jugular band. Bare ring around eye purple; overall coloration can be dark brown or blackish with rufous breast. Crown, crest and face chestnut; throat and foreneck brownish black. Back and rump black or olive with cinnamon vermiculations; scapulars black, or olive with black spots; belly tawny. Bill black, legs blue-black. Female similar, but sides of head darker and duller chestnut, and eye-ring blue-black. Immature similar, but with duller crest; back has white or buffy shaft streaks, belly spotted and

barred with black. Race *verecundus* has upperparts greyer.

Habitat. Tropical and lower subtropical forests at 450-1600 m, locally to sea-level. Found on forest floor in virgin forest and in thick second growth.

Food and Feeding. No information available.

Breeding. Nest found in excavation between buttresses of tree in Costa Rica. Clutch 4 eggs. Eggs cream or white with brown spots, averaging 37.6 x 27.9 mm.

Movements. Presumably sedentary. Found singly, in pairs, or in small groups; groups of up to 10 birds in Costa Rica.

Status and Conservation. Not globally threatened. Mace-Land: possibly Safe. Total population might number under 50,000 birds, and declining. Restricted range; very little information available. Becoming scarce and local in Costa Rica. Major threats include deforestation, and possibly hunting. Extensive surveys required.

Bibliography. Alderton (1992), Blake (1977), Howell (1971), Johnsgard (1979, 1988), Mendez (1979), Monroe (1968), Ridgely & Gwynne (1989), Ridgway & Friedmann (1946), Slud (1964), Stiles & Skutch (1989), Wetmore (1965).

17. Rufous-fronted Wood-quail

Odontophorus erythrops

French: Toco à front roux German: Rotstirn wachtel Spanish: Corcovado Frentirrojo

Other common names: Rufous-breasted Wood-quail

Taxonomy. *Odontophorus erythrops* Gould, 1859, Pallatanga, Ecuador.

Often considered to include *O. melanotis*. May be conspecific with three other species, *O. speciosus*, *O. hyperythrus* and *O. melanotus*. At other extreme, race *parambae* has been considered distinct species. Two subspecies normally recognized.

Subspecies and Distribution.

O. e. parambae Rothschild, 1897 - Pacific slope of Colombia S to W Ecuador; possibly also E Panama.

O. e. erythrops Gould, 1859 - SW Ecuador.



Descriptive notes. 23-28 cm; estimated weight of male 340 g, of female 329 g. Very similar to *O. melanotis*, but has white jugular band. Bare ring around eye purple; overall coloration can be dark brown or blackish with rufous breast. Crown, crest and face rufous; throat and foreneck black. Back and rump black or olive, with cinnamon vermiculations; scapulars black or olive with black spots; breast and belly dark rufous. Bill black, legs blue-black. Female similar, but sides of head darker and duller chestnut, and eye-ring blue-black. Immature similar, but with duller crest; back with white or buffy shaft streaks, belly

spotted and barred with black. Race *parambae* somewhat darker.

Habitat. Humid lowland tropical forest at elevations under 1600 m. Found on forest floor.

Food and Feeding. No information available.

Breeding. No information available.

Movements. Presumably sedentary. One group of 7 individuals observed.

Status and Conservation. Not globally threatened. Mace-Lande: probably Safe. Very little information available; total population might number under 500,000 birds; apparently declining. Common in some areas in Colombia. Major threats include deforestation, and possibly hunting. Some cause for concern in W Andes of Colombia, due to deforestation at lower altitudes; most protected areas and parks are concentrated at higher elevations. Extensive surveys required.

Bibliography. Alderton (1992), Blake (1977), Borrero (1972), Carriker (1910), Chapman (1926), Hilty & Brown (1986), Johnsgard (1979, 1988), Mendez (1979), Meyer de Schauensee (1964), Negret (1991), Ridgway & Friedmann (1946), Robbins *et al.* (1985), Wetmore (1965).

18. Black-fronted Wood-quail

Odontophorus atrifrons

French: Toco à front noir **German:** Schwarzstirnachtel **Spanish:** Corcovado Carinegro

Taxonomy. *Odontophorus atrifrons* Allen, 1900, Santa Marta, Colombia.

May be conspecific with four other species, *O. strophium*, *O. columbianus*, *O. leucolaemus* and *O. dialeucos*. Three subspecies recognized.

Subspecies and Distribution.

O. a. atrifrons Allen, 1900 - Santa Marta Mts, NE Colombia.

O. a. variegatus Todd, 1919 - N end of E Andes, NE Colombia.

O. a. navai Aveledo & Pons, 1952 - Perijá Mts, NE Colombia and NW Venezuela.



Descriptive notes. 25-27 cm; estimated weight of male 311 g, female 298 g. Black forehead, face and throat distinctive; crown rufous brown. Overall coloration blackish brown. Back grey with black vermiculation, becoming browner towards the rump; wings mottled with cinnamon and black; flight-feathers tipped black, but showing white of feather shafts. Bill black, legs dusky horn coloured. Female similar, but underparts more rufescent. Immatures have brownish red upper mandible, and black feathers on throat, tipped with tawny olive. Races differ in extent of black and in overall coloration.

Habitat. Montane tropical and subtropical forests at 1200-3100 m. Found on forest floor.

Food and Feeding. No information available.

Breeding. Male in breeding condition and female laying in Aug; immature found during Jul in Perijá Mts, NW Venezuela.

Movements. Presumably sedentary. Occurs in groups of up to 10 individuals.

Status and Conservation. Not globally threatened. Mace-Lande: possibly Vulnerable. Currently considered near-threatened. Total population might number under 10,000 birds, and declining. Restricted range; very little information available. Possibly common in large protected area in Santa Marta Mts, NE Colombia. Race *navai* protected in Sierra de Perijá National Park, NW Venezuela. Major threats include deforestation, mineral extraction, and possibly hunting. Extensive surveys required.

Bibliography. Alderton (1992), Blake (1977), Borrero (1972), Fjeldsá & Krabbe (1990), Gines & Aveledo (1958), Hilty & Brown (1986), Johnsgard (1979, 1988), Meyer de Schauensee (1964), Meyer de Schauensee & Phelps (1978), Phelps & Phelps (1958), Schwartz & Lenino (1984), Todd & Carriker (1922).

19. Chestnut Wood-quail

Odontophorus hyperythrus

French: Toco marron **German:** Kastanienachtel **Spanish:** Corcovado Castaño

Taxonomy. *Odontophorus hyperythrus* Gould, 1858, Santa Fé de Bogotá, Colombia.

May be conspecific with three other species, *O. speciosus*, *O. erythrops* and *O. melanotus*. Possibly most closely related to *O. speciosus*. Some evidence of differences in plumage colour between populations of W and C Andes. Monotypic.

Distribution. Endemic to C and W Andes of Colombia.



Descriptive notes. 25-28.5 cm; estimated weight of male 392 g, female 351 g. Overall coloration chestnut to dark brown; feathers around eye and ear-coverts white. Head chestnut, foreneck and breast rufous; back, rump and wings mainly brown; upperwing-coverts spotted white; back and rump with fine black vermiculations. Bill black, legs bluish grey. Female similar, but much of breast and belly dark grey. Juvenile similar to adults, but upperwing-coverts and scapulars tipped buff; orange-red tip to bill.

Habitat. Montane subtropical forests at 1600-2700 m, including second growth and forest borders; normally found on forest floor. Some evidence of use of coffee plantations with shade trees. Has been seen roosting in trees.

Food and Feeding. Consumes seeds and berries, and possibly also insects. Forages by scratching in leaf litter for roots, seeds and fruits which have fallen from trees.

Breeding. Generally unknown; laying thought to be during Apr-May, based on gonad development.

Movements. Presumably sedentary. Groups of 3-9 individuals reported.

Status and Conservation. Not globally threatened. Mace-Lande: Vulnerable. Currently considered near-threatened. Total population may number under 10,000 birds, and in decline. Restricted range; very little information available. Populations occur in some protected areas including Las Orquideas, Los Nevados, Cueva de los Guácharos, Munchique and Farallones National Parks. Possibly common at Acaime, in Salento. Major threats include deforestation and possibly hunting. Populations of C Andes apparently more at risk, as more intensive deforestation has resulted in fragmentation and isolation of populations; some populations do appear to persist in small forest fragments. In W Andes, some conversion of forest habitat to pine plantations, with unknown effects on species. Survey work required.

Bibliography. Alderton (1992), Blake (1955, 1977), Borrero (1972), Chapman (1917), Collar & Andrew (1988), Fjeldsá & Krabbe (1990), Hilty (1985), Hilty & Brown (1986), Johnsgard (1979, 1988), Meyer de Schauensee (1964), Miller (1963), Negret (1991), Renjifo (1988), Uribe (1986).

20. Dark-backed Wood-quail

Odontophorus melanotus

French: Toco à dos noir **German:** Schwarzüückenachtel **Spanish:** Corcovado Dorsioscuro
Other common names: Black-backed Wood-quail

Taxonomy. *Odontophorus melanotus* Gould, 1860, Ecuador.

May be conspecific with three other species, *O. hyperythrus*, *O. erythrops* and *O. speciosus*. Probably most closely related to *O. speciosus*. Monotypic.

Distribution. Mountains of NW Ecuador and SW Colombia.



Descriptive notes. 24-27 cm; estimated weight of male 226 g, of female 220 g. Overall colour brownish black; throat and breast reddish chestnut, becoming darker below; brownish black eye-ring. Crown and sides of head, back, rump, wings and belly brownish black with fine chestnut vermiculations. Bill black, legs brownish black. Female identical. Immature dull brown, with reddish bill and greenish grey legs.

Habitat. Lower subtropical forest at altitudes of 1200-1500 m.

Food and Feeding. No information available.

Breeding. No information available.

Movements. Presumably sedentary.

Status and Conservation. Not globally threatened. Mace-Lande: possibly Vulnerable. Currently considered near-threatened. Total population might number under 10,000 birds, with trends unknown. Restricted range; very little information available. Recently found to be common in well protected reserve of La Planada, SW Colombia. Major threats include deforestation, and possibly hunting. Survey work required.

Bibliography. Alderton (1992), Blake (1977), Chapman (1926), Fitzpatrick & Willard (1982), Hilty & Brown (1986), Johnsgard (1979, 1988), Robbins (1981), Schönwetter (1967).



21. Rufous-breasted Wood-quail

Odontophorus speciosus

French: Toco à poitrine rousse German: Rotbrustwachtel Spanish: Corcovado Pechirrufo

Taxonomy. *Odontophorus speciosus* Tschudi, 1843, Peru.

May be conspecific with three other species, *O. hyperythrus*, *O. erythrops* and *O. melanotus*. Possibly most closely related to *O. hyperythrus*. Three subspecies recognized.

Subspecies and Distribution.

O. s. soederstroemii Lönnberg & Rendahl, 1922 - E & S Ecuador.

O. s. speciosus Tschudi, 1843 - EC Peru.

O. s. loricae Todd, 1932 - SE Peru to E Bolivia.



Descriptive notes. 25-26.5 cm; estimated weight of male 332 g, of female 302 g. Breast and belly rufous chestnut; crown dark brown, bordered by black on sides of head and neck, and on throat. Overall coloration brown and chestnut. Ear-coverts brown; white line extending from bill over eye down side of neck; bare eye-ring bluish black. Back and rump brown, with fine black vermiculations and white feather shafts; upwing-coverts spotted with either black or white, and with white feather shafts. Bill black, legs bluish black. Female similar, but rufous chestnut ends on upper breast, and replaced by grey on lower breast and belly. Immature has sides of head, chin and throat chestnut, with dusky margins; white stripe on head narrower; back and rump with reduced shaft stripes; longer scapulars tipped with rufous buff. Races separated on coloration, especially of crown and sides of head.

Habitat. Tropical lowland forest at elevations under 1700 m. Found on forest floor.

Food and Feeding. No information available.

Breeding. No information available.

Movements. Presumably sedentary.

Status and Conservation. Not globally threatened. Mace-Land: Safe. Very little information available; total population might number over 500,000 birds, and possibly stable. Reported to be uncommon in Peru, but fairly common in Podocarpus National Park, S Ecuador. Possible threats include deforestation and perhaps hunting; however, probably more secure than most *Odontophorus*, due to remote distribution. Surveys and research required.

Bibliography. Alderton (1992), Blake (1977), Chapman (1926), Davis (1986), Johnsgard (1979, 1988), Parker *et al.* (1982), Raethel (1988), Remsen & Traylor (1989), Robbins (1981), Terborgh & Weske (1975), Traylor (1958).

22. Tacarcuna Wood-quail

Odontophorus dileucos

French: Toco de Panama German: Tacarcunawachtel Spanish: Corcovado del Tacarcuna

Taxonomy. *Odontophorus dileucos* Wetmore, 1963, Darién, Panama.

May be conspecific with four other species, *O. columbianus*, *O. atrifrons*, *O. leucolaemus* and *O. strophium*. Probably most closely related to *O. strophium*. Monotypic.

Distribution. Endemic to extreme E Panama and adjacent Chocó, NW Colombia.



Descriptive notes. 22-25 cm; estimated weight of male 264 g, of female 258 g. Crown black; separated from black throat by white supercilium, lores and chin. Overall coloration dark or olive-brown. Sides and back of neck cinnamon; back and rump olive brown, with fine black vermiculation; breast and belly chestnut, with fine white specks. Bill black, legs brownish black. Female similar, but paler. Immature similar to female, but with less white on chin, and broader black band on foreneck.

Habitat. Subtropical forest at 1050-1450 m. Found on forest floor.

Food and Feeding. No information available.

Breeding. Virtually no information; immature collected in June.

Movements. Presumably sedentary. Occurs in pairs or in groups of up to 8 individuals.

Status and Conservation. Not globally threatened. Mace-Land: possibly Safe. Currently considered near-threatened. Total population might number under 50,000 birds. Restricted range; very little information available. Threats may include deforestation and hunting. Additional surveys required in Chocó, NW Colombia, to determine status of recently discovered population. Research required.

Bibliography. Alderton (1992), Blake (1977), Hilty & Brown (1986), Johnsgard (1979, 1988), Mender (1979), Pearman (1993b), Ridgely & Gwynne (1989), Robbins (1981), Rodríguez (1982), Wetmore (1963, 1965).

23. Gorgeted Wood-quail

Odontophorus strophium

French: Toco à miroir German: Kragenwachtel Spanish: Corcovado Gorgiblanco

Taxonomy. *Oryx (Odontophorus) strophium* Gould, 1844, Colombia.

May be conspecific with four other species, *O. columbianus*, *O. atrifrons*, *O. leucolaemus* and *O. dileucos*. Monotypic.

Distribution. Endemic to W slope of E Andes of Colombia, where restricted to two areas in departments of Santander and Cundinamarca.

Descriptive notes. 25.5-27 cm; estimated weight 302 g. Black band across foreneck, separating white throat from white upper breast; crown and eyeline brown; cheeks and supercilium white. Overall coloration brownish. Lower breast brown, with rows of white spots ending before rufous belly; back mottled with thin white streaks; scapulars spotted black. Bill and legs black. Female



similar, but grey below, and rows of white spots on breast much reduced. Immature has more brownish grey on breast and sides; white spots on breast reduced to streaks.

Habitat. Montane temperate and subtropical forests at 1500-2050 m, especially those dominated by *Quercus humboldtii*. Found on forest floor. Will use second growth forest.

Food and Feeding. Feeds on fruits and seeds, including *Quercus humboldtii*, *Trigonobalanus*, *Cavendishia guatapiensis* and *C. cf. nitida*, *Macleania rupestris*, *Miconia theaezans*, *Myrica pubescens*, *Rapanea ferruginea*, *Ficus boyacensis*, and *Norantea mista*; also known

to take arthropods.

Breeding. Breeding season apparently coincides with peaks of annual rainfall during Mar-May and Sept-Nov (based on several adults collected in breeding condition, and immatures collected in Dec). No further information available.

Movements. Presumably sedentary. Occurs in small groups of 1-3 birds.

Status and Conservation. VULNERABLE/RARE. Mace-Land: Endangered. Total population thought to number under 2500 birds, and still declining. Restricted range, encompassing area only c. 280 km long at maximum; very little information available. Major threats include deforestation, and hunting. Cachalú Wildlife Sanctuary of 10,000 ha established at Guanentá-Alto Río Fonce in temperate forests in vicinity of Virolín, Santander; efforts under way to consolidate reserve and set up research projects. No recent evidence of populations in Cundinamarca, where few forest patches remain, and species last recorded in 1923.

Bibliography. Alderton (1992), Blake (1977), Borrero (1972), Brooke (1988), Chapman (1917), Collar & Andrew (1988), Collar *et al.* (1992), Fjeldså & Krabbe (1990), Hilty (1985), Hilty & Brown (1986), Johnsgard (1979, 1988), King (1978/79), Kuroda (1970), Meyer de Schauensee (1964), Romero-Zambrano (1983).

24. Venezuelan Wood-quail

Odontophorus columbianus

French: Toco du Venezuela German: Venezuelawachtel Spanish: Corcovado Venezolano

Taxonomy. *Odontophorus columbianus* Gould, 1850, Caracas, Venezuela.

May be conspecific with four other species, *O. strophium*, *O. atrifrons*, *O. leucolaemus* and *O. dileucos*. Monotypic.

Distribution. Endemic to NC Venezuela.



Descriptive notes. 28-30 cm; estimated weight of male 343 g, of female 336 g. Overall coloration reddish brown with pale streaks on upwing-coverts; throat and chin white with black streaks. Large white droplets on breast, belly and flanks. Bill black, legs dark grey. Female lacks pale streaks on closed wing and has much reduced white droplets on underside. Juvenile shows lesser development of pale streaks and white spots; bill orange.

Habitat. Montane subtropical cloud forests at altitudes of 1100-2000 m. Found on forest floor. Has been seen roosting above ground on palm fronds.

Food and Feeding. Little information. Consumes seeds, fruits, insects and worms. Forages by scratching litter to expose soil; also scrapes into soil, apparently to feed on fleshy roots.

Breeding. From Mar perhaps to end of Jul. One chambered nest with roof of vegetation found at base of palms. One clutch of 6 eggs. Eggs white, measuring 40.5-43.5 mm x 29.0-29.5 mm. Incubation 30 days.

Movements. Presumably sedentary. During Jan, singles, pairs and groups of up to 9 birds observed.

Status and Conservation. Not globally threatened. Mace-Land: possibly Vulnerable. Currently considered near-threatened. Total population might number under 10,000 birds, and declining. Restricted range; very little information available. Populations occur in some protected areas, including San Esteban National Park. Possibly still common in some protected areas; more than a dozen groups recorded at Rancho Grande, Henri Pittier National Park, during survey in Jan 1994. Major threats include deforestation, hunting and urbanization. Research and surveys required.

Bibliography. Alderton (1992), Blake (1977), Fjeldså & Krabbe (1990), Gines & Alveledo (1958), Johnsgard (1979, 1988), Laskowski *et al.* (1992), Meyer de Schauensee & Phelps (1978), Phelps & Phelps (1958), Schäfer (1953b), Schäfer & Phelps (1954), Schwartz & Lentino (1984), Zimmer & Phelps (1954).

25. Black-breasted Wood-quail

Odontophorus leucolaemus

French: Toco à poitrine noire German: Weißkehlwachtel Spanish: Corcovado Pechinegro
Other common names: White-throated Wood-quail

Taxonomy. *Odontophorus leucolaemus* Salvin, 1867, Cordillera de Tolé, Veraguas, Panama.

May be conspecific with *O. strophium*, *O. atrifrons*, *O. columbianus* and *O. dileucos*. Proposed race *smithianus*, from Dota Mts of Costa Rica, generally considered a melanistic morph. Monotypic.

Distribution. NE, E & C highlands of Costa Rica S to W Panama. Most records on Caribbean slope.

Descriptive notes. 22-25.5 cm; estimated weight of male 226 g, of female 220 g. Crown, crest and ear-coverts black; large white patch on throat; neck and breast black with dull-white feather tips. Overall coloration dark brown. Belly brown with fine black vermiculations. Iris brown, bill black, legs dark grey. Sexes similar. Juvenile browner on breast; bill brown or red. Population of Dota Mts (Costa Rica) smaller and almost entirely black.

Habitat. Tropical and subtropical forests at 800-1850 m, including second growth and forest borders, but mostly in interior of forest. Found on forest floor, generally in thickest vegetation, e.g. in scrub and amongst vines.

Food and Feeding. Virtually no information available; may take plant matter, supplemented with insects.



Breeding. Nests found in Jun. Nests in heavily shaded second growth along bank of stream; nest is hollow in leaf litter, measuring 24 x 13 cm. Clutches of 5 eggs. Eggs white, but become stained brown; 44.5 x 28.7 mm. Incubation said to be 16-17 days. Apparently groups of adults guard nest-site, but do not assist with incubation. **Movements.** Presumably sedentary. Moves about in pairs or groups of 10-15 birds. **Status and Conservation.** Not globally threatened. Mace-Land: possibly Safe. Currently considered near-threatened. Total population might number under 50,000 birds; perhaps declining. Restricted range; very little information available.

Generally rare in Costa Rica, although locally common; most records from Panama are old. Isolated population in Dota Mts, Costa Rica. Reported to be common at Monteverde Reserve, Puntarenas, Costa Rica. Major threats possibly include deforestation and hunting. Extensive surveys required.

Bibliography. Alderton (1992), Blake (1958, 1977), Carriker (1910), Johnsgard (1979, 1988), McDonald & Winnett-Murray (1989), Mendez (1979), Ridgely & Gwynne (1989), Ridgway & Friedmann (1946), Slud (1964), Stiles & Skutch (1989), Wetmore (1965)

26. Stripe-faced Wood-quail

Odontophorus balliviani

French: Toco de Ballivian

Spanish: Corcovado Enmascarado

German: Streifengesichtwachtel

Taxonomy. *Odontophorus balliviani* Gould, 1846, Cochabamba, Bolivia. Monotypic.

Distribution. Endemic to E Andes of SE Peru, and N & W Bolivia, in La Paz and Cochabamba.



Descriptive notes. 26-28 cm; estimated weight of male 311 g, of female 324 g. Crest and crown chestnut bordered by buff; eye-ring red, with black stripe behind eye extending along edge of nape. Overall coloration brown. Buff throat, with lines of white streaks becoming diamond-shaped spots; bordered by black on breast, belly and flanks. Ground colour of breast and belly brown; back and rump brown, mottled with black vermiculations; scapulars and wings brown, with black and chestnut spots. Bill black, legs dark lead. Female very similar, but may have fewer white streaks on throat. Immature not described.

Habitat. Montane subtropical forest at 2000-3000 m; found in heavy forest, stunted cloud forest, clearings and boggy meadows.

Food and Feeding. No information available.

Breeding. Egg size 38 x 26.8 mm.

Movements. Presumably sedentary.

Status and Conservation. Not globally threatened. Mace-Land: possibly Safe. Total population might number under 50,000 birds; perhaps in decline. Restricted range; very little information available. Threats possibly include deforestation, urbanization and agriculture. Rarely reported in wild, but inhabits areas with difficult access. Reported to be uncommon in Peru. Surveys required to evaluate populations and delimit distribution.

Bibliography. Alderton (1992), Blake (1977), Fjeldså & Krabbe (1990), Johnsgard (1979, 1988), Parker *et al.* (1982), Remsen & Traylor (1989), Robbins (1981), Schönwetter (1967).

27. Starred Wood-quail

Odontophorus stellatus

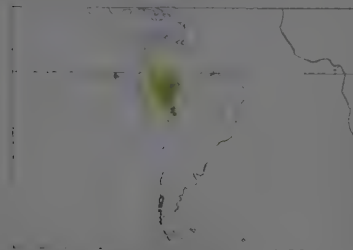
French: Toco étoilé

German: Sternwachtel

Spanish: Corcovado Estrellado

Taxonomy. *Odontophorus stellatus* Gould, 1843, Brazil. Monotypic.

Distribution. Upper Amazon region: extreme E Ecuador, E Peru and W Brazil (S of Amazon, E to Rio Madeira) S to NW & NE Bolivia. Possibly also occurs in extreme SE Colombia.



Descriptive notes. 24-26 cm; estimated weight of male 358 g, of female 315 g. Large crest rufous chestnut; head and neck ash grey; yellow eye-ring; sometimes has white flecking on supercilium. Overall colour brown to rufous. Back brown to rufous, fading to buff on rump, with fine black vermiculations; scapulars with black spots and white feather shafts; upperwing-coverts tipped white. Breast chestnut-rufous, but paler medially; sparse white diamonds, like teardrops, on sides of breast. Bill and legs black. Female similar, but crest darker brown or brownish black. Immature similar, but bill reddish orange to yellow.

Habitat. Lowland tropical forest.

Food and Feeding. No information available.

Breeding. No information available.

Movements. Presumably sedentary.

Status and Conservation. Not globally threatened. Mace-Land: Safe. Very little information available; total population might number over 750,000 birds. Reported to be fairly common in Peru. Possible threats include deforestation and possibly hunting; however, isolated distribution probably makes it more secure than most other members of *Odontophorus*. Research required.

Bibliography. Alderton (1992), Blake (1977), Chammán (1921, 1926), Gysels-Simpe (1945, 1951), Hilty & Brown (1986), Johnsgard (1979, 1988), Parker *et al.* (1982), Pinto (1964), Remsen & Traylor (1989), Robbins (1981), Rosen (1979), Siek (1985a), Terborgh & Weske (1975), Terborgh *et al.* (1984), Traylor (1958).

28. Spotted Wood-quail

Odontophorus guttatus

French: Toco tacheté

German: Tropfenwachtel

Spanish: Corcovado Goteado

Taxonomy. *Ortyx guttatus* Gould, 1838, Bay of Honduras = Belize.

Proposed race *matudae* known only from one location, and not normally considered valid. Monotypic. **Distribution.** S Mexico (S México State to Yucatán) and Belize through N Guatemala and W & C Honduras into bordering Nicaragua; two further small populations, one in N Costa Rica, and one in S Costa Rica and adjacent W Panama.



Descriptive notes. 23-26.5 cm; average male 300 g, female 288 g. Polymorphic in both sexes, with brown and red morphs. Brown morph has crown blackish brown with orange crest; sides of head and neck cinnamon; throat black with white streaks; breast and belly brown with white spots, round or like teardrops. Overall coloration brown. Back and rump dark brown, with white feather shafts and black and buff mottling. Bill and legs dull green or black. Red morph differs mainly in reddish brown breast. Female similar, but crest blackish. Immature has rusty red crest, and breast markings more in form of streaks than of spots; bill orange-red.

Habitat. Tropical and subtropical montane forests at 500-3000 m, although locally to lower elevations, e.g. to 100 m in Costa Rica. Found on forest floor with sparse understorey and also older second growth. In Costa Rica reported from forest edge and up to tree-line.

Food and Feeding. Small bulbs, rootlets, flesh of large nuts and insects, including pupae and larvae (of Diptera, Coleoptera). Food obtained by scratching forest litter in circles up to 30 cm in diameter to reach bare ground. In captivity, will eat fruits, softened and hard grain, and dried beans.

Breeding. Nesting possibly May-Jun in Yucatán, Mexico; young chicks in May in Chiapas, S Mexico, and Guatemala; male in breeding condition from Belize in Mar; "well grown young" collected in Mexico during Dec. Nests on ground. Eggs white, sometimes with brown spots; size 39.2-40.5 x 28.5-29.7 mm.

Movements. Presumably sedentary; might undertake altitudinal migrations in Costa Rica. Circulates in coveys of 6-20 birds in Mexico, but only 1-4 just prior to breeding; groups of 4-10 birds in Costa Rica; larger coveys are apparently not family groups.

Status and Conservation. Not globally threatened. Mace-Land: Safe. Very little information available; total population might number under 500,000 birds, possibly declining. Apparently common in many parts of range. Major threats include deforestation, and possibly hunting. Although found in small and rather isolated populations, apparently more capable of withstanding habitat destruction and fragmentation than other members of *Odontophorus*.

Bibliography. Alvarez del Toro (1952), Binford (1989), Blake (1953, 1958, 1977), Briggs (1954), Brodtkorb (1943), Carriker (1910), Davis (1972), Edwards (1989), Edwards & Lea (1955), Griscom (1932), Johnsgard (1973, 1979, 1988), Land (1970), Leopold (1959), Lowery & Dalquest (1951), Mendez (1979), Monroe (1968), Paynter (1955), Pielka (1948), Ridgely & Gwynne (1989), Ridgway & Friedmann (1946), Russell (1964), Saunders *et al.* (1950), Slud (1964), Smithe (1966), Stiles & Skutch (1989), Traylor (1941), Van Tyne (1935), Wetmore (1965).

Genus *DACTYLORTYX* Ogilvie-Grant, 1893

29. Singing Quail

Dactylortyx thoracicus

French: Colin chanteur

German: Singwachtel

Spanish: Colin Cantor

Other common names: Long-toed Quail/Partridge

Taxonomy. *Ortyx thoracicus* Gambel, 1848, Jalapa, Veracruz, Mexico.

As many as ten races of doubtful validity. Seventeen subspecies normally recognized.

Subspecies and Distribution.

D. t. pettingilli Warner & Harrell, 1957 - SE San Luis Potosí and SW Tamaulipas, CE Mexico.

D. t. thoracicus (Gambel, 1848) - NE Puebla and C Veracruz, EC Mexico.

D. t. devius Nelson, 1898 - Jalisco, WC Mexico.

D. t. melodus Warner & Harrell, 1957 - C Guerrero, SC Mexico.

D. t. ginetensis Warner & Harrell, 1957 - SE Oaxaca and W Chiapas, S Mexico.

D. t. edwardsi Warner & Harrell, 1957 - W Chiapas, S Mexico.

D. t. chiapensis Nelson, 1898 - C Chiapas, S Mexico.

D. t. moorei Warner & Harrell, 1957 - mountains of C Chiapas, S Mexico.

D. t. dolichonyx Warner & Harrell, 1957 - Sierra Madre de Chiapas, Chiapas, S Mexico.

D. t. sharpei Nelson, 1903 - SE Mexico (Campeche, Yucatán and Quintana Roo) and N Guatemala; possibly also Belize.

D. t. paynteri Warner & Harrell, 1955 - SC Quintana Roo, SE Mexico.

D. t. calophonus Warner & Harrell, 1957 - W Guatemala.

D. t. salvadoranus Dickey & van Rossem, 1928 - Volcán de San Miguel, El Salvador.

D. t. taylori van Rossem, 1932 - Mt Cacaguatique, El Salvador.

D. t. fuscus Conover, 1937 - Tegucigalpa Department, Honduras.

D. t. rufescens Warner & Harrell, 1957 - San Juancito Mts, Honduras.

D. t. conoveri - Warner & Harrell, 1957 - Olancho Department, Honduras.



Descriptive notes. 20-23 cm; male 180-266 g, female 168-206 g. Toes and claws very long. Overall coloration grey and brown with white streaks. Crown dark brown, collar buff with black spots; supercilium, chin, sides of neck and throat tawny orange; black streak extending from back of eye to collar. Back and wings mottled grey and brown, with white shaft streaks; rump olive brown or grey with black vermiculations. Breast and belly greyish brown with white streaks, lower belly white. Bill blackish brown, legs plumbeous. Female similar, but sides of head grey fading to white on throat; breast and flanks paler brown. Immature similar

but sides of head more cinnamon-buff in males and less ochraceous in females. Races separated on coloration and size: darker birds from montane forests, paler ones from more arid areas; largest individuals found in populations occurring in mountains, whereas smallest found near sea-level in Yucatán.

Habitat. Variable depending on population: subtropical montane and cloud forests at 1000-3000 m; in Yucatán Peninsula, locality to lower altitudes in deciduous scrub. Observed to be common in forests of oak and sweet gum. Found on forest floor with sparse understorey, and also in older second growth, especially at edges of old growth and clear-cut areas. Found in coffee plantations in El Salvador.

Food and Feeding. Small bulbs and seeds, e.g. pokeweed (*Phytolacca*), and insects including centipedes, crickets, fly larvae, grasshoppers and grubs. May eat coffee beans. Very strong feet and long claws allow food to be obtained by scratching in forest litter and soil.

Breeding. Season may extend from Feb to Oct: birds in breeding condition found during late Mar and Apr; in Yucatán, SE Mexico, nest found during May, and young chicks during Jul and Aug; young chicks in Tamaulipas, E Mexico during Apr; downy chick during Jul in Guatemala. Song distinctive and duetting reported. Clutch of 5 eggs found in Yucatán, where broods of 2-4. Eggs white with yellow markings, averaging 29-31 x 23.5-25 mm.

Movements. Presumably sedentary.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Very little information available; total population may number 100,000-500,000 birds. Appears to be locally common in many parts of range. Threats include deforestation, and possibly hunting and grazing in forests. Although found in small and rather isolated populations, apparently more capable of withstanding habitat destruction and fragmentation than other quails of Central and South America. Extensive surveys required.

Bibliography. Alderton (1992), Baepler (1962), Banks (1987), Binford (1989), Blake (1953, 1977), Davis (1972), Dickey & van Rossem (1938), Edwards (1989), Edwards & Lea (1955), Griscom (1932), Harrell (1951), Johnsgard (1973, 1988), Land (1970), LeFebvre & LeFebvre (1958), Leopold (1959), Monroe (1968), Paynter (1955), Ridgway & Friedmann (1946), Saunders *et al.* (1950), Schaldach (1963), Schönwetter (1967), Smithe (1966), Sutton & Pettingill (1942), Warner & Harrell (1957).

Genus *CYRTONYX* Gould, 1844

30. Montezuma Quail

Cyrtonyx montezumae

French: Colin arlequin **German:** Montezumawachtel **Spanish:** Colín de Montezuma
Other common names: Harlequin Quail; Mearns Quail (*mearnsi*); Salle's Quail (*sallei*)

Taxonomy. *Oryx Montezumae* Vigors, 1830, Mexico.

May be conspecific with *C. ocellatus*, with which forms superspecies. Race *sallei* sometimes considered full species. Five subspecies recognized.

Subspecies and Distribution.

C. m. mearnsi Nelson, 1900 - scattered populations in S USA (W & C Texas, S New Mexico and S Arizona) and N & NW Mexico. Also reported from Nayarit, CW Mexico.

C. m. montezumae (Vigors, 1830) - Tamaulipas S through Hidalgo to Oaxaca, E Mexico; sometimes claimed not to occur in Oaxaca.

C. m. merriami Nelson, 1897 - Mt Orizaba, Veracruz, EC Mexico.

C. m. sallei J. Verreaux, 1859 - S Michoacán, Guerrero and W Oaxaca, S Mexico.

C. m. rowleyi Phillips, 1966 - Guerrero and Oaxaca (Sierra de Miahuatlán), Mexico.



Descriptive notes. 20-22 cm; average in Mexico, male 195 g and female 176 g, but in Arizona, USA, male 209 g and female 193 g. Very distinctive head pattern; heavy spotting on flanks distinguishes from *C. ocellatus*. Crest tan, head mostly blackish, with forecrown stripe, orbital and postorbital areas, sides of neck and part of throat white; throat black medially, as is malar region. Overall coloration greyish to olive brown, combined with black and white. Hind neck and back olive brown with buff streaks; rump greyish, with white feather shafts, and brown and black barring; scapulars and upperwing-coverts olive brown, with black barring

and tan streaks. Sides of breast and belly black with large white, cinnamon or rufous brown dots; breast medially brown, turning to black on belly. Bill bluish grey, legs grey. Female has crown and small crest buffy with black spots; sides of head white with tan streaks, throat white; back, rump and wings olive brown, with buff shaft streaks and black spots; breast and belly tan with black streaks, medially fading to white or buff streaks on side. Immature resembles female, but young males acquire black belly. Races separated on coloration; *merriami* lacks white band behind black throat; *mearnsi* has upperwing greyish; *sallei* intermediate between nominate *montezumae* and *C. ocellatus*.

Habitat. Open pine and oak woodlands, pure oak woodlands and oak grasslands at 1060-3000 m. Found on forest floor and in thick brush.

Food and Feeding. Primarily bulbs and tubers during dry periods, and insects during wet season. In Mexico, bulbs of *Cyperus esculentus* most common, but also bulbs of *Oxalis*, *Brodiaea* and *Echeandia terniflora*; also seeds and fruits of legumes, wheat, corn, *Physalis*, *Kalmia latifolia*, *Arbutus*, *Juniperus*, *Pinus cembroides*, *Rhus*, *Quercus virginiana* and *Helianthus*. Animal foods include Hymenoptera, Diptera, Lepidoptera, Coleoptera, Homoptera, Orthoptera, Isoptera, Araneida, and Chilopoda. Similar in Arizona, USA, with *Oxalis* and *Cyperus* most important items. Most noted for stout legs and long claws for digging up tubers and bulbs. Standing water apparently not needed.

Breeding. In Arizona, pairing Mar-May and nesting late Jun-Sept, apparently coinciding with summer rain. Domed nests constructed with lining of grasses or oak (*Quercus*) leaves, and roofed with grasses; 15 cm diameter and 10 cm high. Average clutch 11-1 eggs (6-14); eggs white, although often stained, averaging 32 x 25 mm. Incubation 25-26 days; males reported incubating eggs and assisting with rearing of brood.

Movements. Sedentary. Occurs in coveys of 7-8 birds, rarely up to 25. Home range of up to 50 ha, but usually under 6 ha.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Total population may number over 500,000 birds. Populations and range in USA declining, as result of overgrazing; but overall population in USA stable since 1960's. Possible threats include deforestation and hunting. In Mexico, overgrazing possibly detrimental; in Arizona, USA, grazing of over 55% of vegetation can eliminate a population; in Texas, USA, grazing of 40-50% of tall grasses results in extirpation. Better studied in USA than in Mexico. Race *sallei* (sometimes considered full species) currently considered near-threatened. Races *mearnsi* and *montezumae* on CITES II.

Bibliography. Albers & Gehlbach (1990), Alden (1969), Bailey (1928), Bent (1932), Binford (1989), Bishop (1964), Bishop & Hungerford (1965), Blake (1953), Briggs (1954), Brown, D.E. (1989), Brown, R.L. (1969, 1982), Campbell (1934), Church & Dailey (1993), Edwards (1989), Escalante (1988), Fleming & Baker (1963), Fuertes (1903), Glass & Potter (1944), Gorsuch (1934), Johnsgard (1973, 1975, 1988), Leopold (1959), Leopold & McCabe (1957), Ligon (1927, 1961), Marín *et al.* (1951), Miller, L. (1943), Miller, W. (1905), Petrides (1942), Phillips (1966), Pietika (1948), Ridgway & Friedmann (1946), Robertson (1932), van Rossem (1945), Rowley (1966, 1984), Schaldach (1963), Soria (1986), Stokes & Williams (1971), Stromberg (1901), Sutton & Phillips (1942), Swarth (1909), Terres (1980), Urban (1959), Vornes (1928), Walimo (1954), Willard (1913).

31. Ocellated Quail

Cyrtonyx ocellatus

French: Colin ocellé

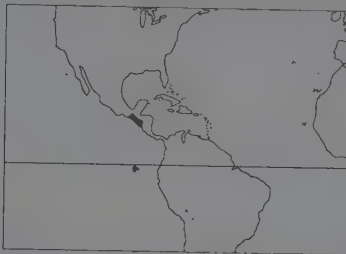
German: Tränenwachtel

Spanish: Colín Ocellado

Taxonomy. *Oryx ocellatus* Gould, 1837, unknown = Guatemala.

May be conspecific with *C. montezumae*, with which forms superspecies. Possible race *differens* described from Honduras, but not usually considered valid. Monotypic.

Distribution. S Mexico, through W Guatemala, E El Salvador and Honduras to N Nicaragua.



Descriptive notes. 19-23 cm; estimated weight of male 218 g, of female 182 g. Very distinctive head pattern; unlike *C. montezumae*, spotting on sides of upper breast fades away on flanks; breast and sides cinnamon, with grey tips on sides. Crown and hindneck olive brown; sides of head and neck bluish grey; orbital and post-orbital areas, side of neck and part of throat white; throat medially black, as is malar region. Overall coloration grey, brown and cinnamon. Back, rump, scapulars and upperwing-coverts grey and brown with cinnamon streaks and black spots, fading to chestnut streaks and black spots towards rear; primaries with white spots; belly black. Bill black to pale blue, legs grey. Female has brown crown with black spots; less extensive white on head, with black feather tips; malar region and side of head tawny, with black streaks rather than bluish grey; back, rump, scapulars and upperwing-coverts brown, with black vermiculations and buff stripes; breast and belly vinaceous, with black streaks along feather shafts. Immature most like female, but young males have more white on throat and some black on belly.

Habitat. Open pine and oak woodlands and brushy fields at 750-3050 m. Found on forest floor and in thick brush.

Food and Feeding. Most likely similar to *C. montezumae*, especially in use of *Oxalis*.

Breeding. Nesting season possibly Apr-Aug in Guatemala. Egg size 32.3 x 25.1 mm.

Movements. Apparently sedentary. Coveys of about a dozen birds reported.

Status and Conservation. Not globally threatened. Mace-Lande: possibly Safe. Currently considered near-threatened. Total population may number under 50,000 birds, and declining. Restricted range; very little information available. Said to be rare in S Mexico in early 1970's, perhaps as result of habitat deterioration due to overgrazing. Current threats may include deforestation, hunting and overgrazing. In S Mexico, birds of this species often kept as pets in cages. Surveys required.

Bibliography. Alderton (1992), Alvarez del Toro (1952), Binford (1989), Blake (1953, 1977), Briggs (1954), Davis (1972), Dickerman (1987b), Dickey & van Rossem (1938), Edwards (1989), Edwards & Lea (1955), Griscom (1932), Johnsgard (1973, 1988), Land (1970), Leopold (1959), Monroe (1968), Ridgway & Friedmann (1946), Saunders *et al.* (1950), Thurber *et al.* (1987).

Genus *RHYNCHORTYX* Ogilvie-Grant, 1893

32. Tawny-faced Quail

Rhynchortyx cinctus

French: Colin ceinturé

German: Langbeinwachtel

Spanish: Colín Carirufu

Other common names: Banded Wood-quail

Taxonomy. *Odontophorus cinctus* Salvin, 1876, Veraguas, Panama.

Birds of E Panama have been separated into race *hypopius*, but this division not normally accepted.

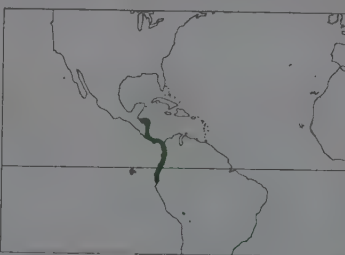
Three subspecies recognized.

Subspecies and Distribution.

R. c. pudibundus Peters, 1929 - NE Honduras and E Nicaragua.

R. c. cinctus (Salvin, 1876) - Caribbean coast of Costa Rica and Panama.

R. c. australis Chapman, 1915 - Pacific coast of Colombia & Ecuador.



Descriptive notes. 17-20 cm; male 165 g. Forehead, sides of head, and malar region rufous; black streak through eye to side of neck. Overall coloration grey and brown. Crown and hindneck dark brown; neck and upper breast grey; back and rump fading from grey to brown with black streaks; scapulars and coverts mottled with black and cinnamon, and white shaft streaks; lower breast and belly tawny buff, fading to white between legs. Bill and legs bluish grey. Female generally browner, with dark brown crown, head and neck; white eyeline, chin and throat; white streaks on side of head; back and upper breast brown, rump mottled

brown and chestnut, with small white spots; scapulars and upperwing-coverts olive and brown, with large black spots, small white spots, and white feather shafts; lower breast and belly with black barring along front and sides. Immature male resembles female but darker and less brown above. Races differ in plumage tone, *pudibundus* generally paler, *australis* darker.

Habitat. Lowland tropical forest at elevations under 1410 m. Most commonly found on forest floor.

Food and Feeding. Seeds, worms and insects recorded. Tends to peck with bill rather than scratch in litter.

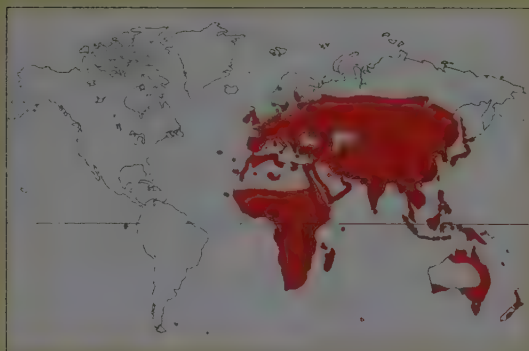
Breeding. Female with developed egg collected during Mar, and downy young during Mar and Apr in Panama. Eggs white, measuring 29.6-30.4 x 23.5-23.8 mm.

Movements. Presumably sedentary. Usually found in pairs, but groups of up to 8 birds reported.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Very little information available; total population may number under 500,000 birds, perhaps declining. Apparently common in parts of Colombia, but rare and local in other areas. Rare and local in Panama, and no definite reports in W Panama. Major threats possibly include deforestation and hunting. Extensive surveys required.

Bibliography. Alderton (1992), Blake (1977), Borren (1972), Chapman (1917, 1926), Hilly & Brown (1986), Howell (1971), Johnsgard (1988), Kart (1971), Melder (1979), Meyer de Schauensee (1968), Monroe (1968), Ottaviani (1957), Ridgely & Gwynne (1989), Ridgway & Friedmann (1946), Robbins *et al.* (1985), Schönwetter (1967), Slud (1964), Stiles & Skutch (1989), Wetmore (1963, 1965).

Class AVES
Order GALLIFORMES
Suborder PHASIANI
Family PHASIANIDAE
(PHEASANTS AND PARTRIDGES)



- Small to large terrestrial birds, with plump body, short, stout bill, short, rounded wings and short or very long tail; plumage drab or spectacular.
- 14-250 cm (maximum includes tail 160 cm).



- Old World, with greatest diversity in SE Asia and Africa.
- Open areas or forest, from sea-level up to snow-line.
- 38 genera, 155 species, 399 taxa.
- 40 species threatened; 1, probably 2, species extinct since 1600.

Systematics

Phasianidae is the largest family in Galliformes, comprising some 155 species distributed throughout much of the Old World. The Galliformes are generally thought to be most closely related to the Anseriformes, perhaps linked by the screamers (Anhimidae). However, although many authors support this view, it has also been claimed that the two orders are not closely related, because the Anseriformes are derived from Charadriiformes.

Whilst there is a large fossil record for the Galliformes, a revision of all available material is urgently needed before much can be said about the evolutionary history of the order. There seem to have been many different pheasant- and partridge-like species present in Europe during the Tertiary, the earliest fossils appearing to be those in Britain which were deposited during the Lower Eocene. All those that date to before the Pliocene are considered to belong to genera which are now extinct, although a mid-Miocene fossil found in Namibia may prove to be that of a primitive francolin.

Within the Galliformes, the composition and relationship of the families has provoked as much discussion as the relationships of the Galliformes with other avian orders. The relationships between the families have been the subject of much study, the features investigated including osteological characters, wing muscle anatomy, DNA-DNA hybridization, immunology and karyology. There have been various proposals of different arrangements into suborders and superfamilies. The Hoatzin (*Opisthocomus hoazin*) has often been considered a galliform, although it has tended to be split off from all the remaining 280 or so species in its own suborder. In recent years there has been a move to transfer it to the Cuculiformes, but as there are strong opponents to both this version and the more traditional one, and as there is no decisive evidence to link this species closely with either group, it is probably best treated in its own monospecific order.

Once the Hoatzin is excluded, most authors have tended to arrange the remaining species into two or three discrete groups, usually separating the megapodes and cracids from all the other species. Current feeling is mostly that the order should be split into two suborders, but there are three suggestions as to how the families might be partitioned between these two. It has been

proposed by some authors that one of the suborders should contain just the megapodes, by others that it should comprise the megapodes and the cracids, and by yet others that it should consist of the megapodes and cracids together with guineafowl. In each of these cases, the other suborder would be made up of the remaining families. The grouping together of the megapodes and cracids, on the one hand, and all other Galliformes, on the other, is the proposal that is most widely accepted, whereas a recent suggestion that the former be raised to order status, the Craciformes, is more controversial.

The family Phasianidae has itself, at times, been considered to include the turkeys, grouse, guineafowl and New World quails, in addition to the pheasants, partridges, Old World quails, snowcocks and francolins, essentially all the Gallifor-



Subdivision of the Phasianidae.

[Figure: Hilary Burn & Francesc Jutglar]

The discovery of the Udzungwa Forest-partridge was one of the major surprises for the ornithological world in recent years. It was first found in the Udzungwa Mountains of southern Tanzania in 1991, and was initially thought to be a francolin. When scientifically described in early 1994, it was placed in a monotypic genus, and is believed to be most closely related to the Arborophila hill-partridges of Asia. Its occurrence in Africa is therefore remarkable from a biogeographical perspective and may shed light on the evolution of the family.

[*Xenoperdix udzungwensis*,
Udzungwa Mountains,
Tanzania.

Photo: Thomas Lehmberg]



mes except for the cracids and megapodes. The uncertainty of the phylogenetic relationships within this assemblage is attributable to the fact that, whilst external morphology and behaviour have diverged extensively among these species, the skeletal anatomy varies only subtly and relatively continuously. The result is that the assemblage typically comprises many genera, each containing few species, the phylogenetic relationships of which are unclear.

The reduction of the Phasianidae from this large collection of around 200 species to the 155 currently accepted is not universally agreed upon, and some recent classifications continue to include some or all of the guineafowl, turkeys, grouse and New World quails, as subfamilies within Phasianidae. What is apparent is that, with time, the various groups are increasingly being regarded as differing from each other in important ways. For example, the distant relationship that the New World quails have with the rest of this group has been appreciated for some time, but while their elevation to family rank was proposed a long time ago, it is only very recently that this view has been generally approved of. At the same time, the guineafowl, which are usually considered to link the Phasianidae with the Cracidae, have generally been restored to family status. The taxonomic status of both the turkeys and the grouse has continually alternated between family and subfamily, though again the family status of the grouse has recently been reasserted.

The differing opinions as to how the divisions may best reflect phylogenetic affinities are again evident below the family level, within the Phasianidae. Whilst the use of two subfamilies, the Phasianinae and Perdicinae, is useful, the relationship is by no means so clear cut. When considering the expanded Phasianidae referred to above, for example, some six subfamilies were proposed, three of which included species covered herein: Pavoninae, comprising the two Asiatic peafowl, the argus pheasants, the peacock-pheasants and the Congo Peafowl (*Afropavo congensis*); the Gallinae, which included the junglefowl, the Old World quails, the partridges and the francolins; and the Phasianinae, made up of the "true" pheasants and the New World quails, which are now separated in the Odontophoridae. The tragopans and the Blood Pheasant (*Ithaginis cruentus*), usually placed alongside the true pheasants, have

often been thought of as the link between the partridges and the pheasants, because of their partridge-like behaviour.

Furthermore, a recent study of 12 galliform species using multilocus protein electrophoresis suggested that the peafowl are more closely related to the guineafowl than to other pheasants. A second finding was that the Grey Partridge (*Perdix perdix*) may, in fact, be a small pheasant rather than a partridge!

What is apparent from the large number of studies that have used many different techniques in attempts to unravel the relationships within the Galliformes in general, and the Phasianidae in particular, is that the relationships are still poorly understood. Indeed, at least 17 different phylogenies have been proposed. There are two separate requirements, however, which reflect different priorities. The first is that of understanding the affinities within the Galliformes, so that their evolutionary history and relationships can be explored. The second is the more immediate need for a standard list of species so that all those interested in the group who are not evolutionary biologists are clear that when one particular genus, species or whatever is being discussed, the different participants are all referring to a unit that is universally agreed upon. Ideally, the latter would be based upon the former, but given the many conflicting phylogenies proposed for the Galliformes, in practical terms this is far from easy. Fortunately, however, the standard list of species included within the Phasianidae has remained more or less consistent for most works. This is especially true of the pheasants, for which J. Delacour's sequence is usually followed.

In deciding on a suitable sequence for the pheasants, Delacour did not have an easy task. Much of the early pheasant taxonomy was based on the collection of one or a few specimens from few, often widely separated, localities. Subsequent reference to existing type specimens resulted in many taxa being proposed on the basis of minor differences. As an example, he faced a particular problem with what are nowadays known as the Kalij Pheasant (*Lophura leucomelanos*) and the Silver Pheasant (*Lophura nymthemera*), which have 9 and 15 subspecies respectively. These two species, long considered a superspecies, contain forms originally described as at least 49 different taxa in 28 species belonging to four genera.



The taxonomy of the many forms included in the Asian genus *Arborophila* is one of the main taxonomic problems affecting the Phasianidae. Some forms are treated as full species by some authors, but only as subspecies by others, while some are even considered by different authors to be subspecies of different species. Several have frequently been placed in a different genus, *Tropicoperdix*. This Common Hill-partridge shows some of the characteristic features of the genus, such as the striking black and whitish head markings and the small areas of bare red skin around the eye.

[*Arborophila torqueola*.
Photo: Eric & David
Hosking/FLPA]

Although much of the sequence of pheasants is largely undisputed, there are a couple of minor points of disagreement. One is the order of the two genera *Gallus* and *Lophura*, and the other is whether the Congo Peafowl should precede or follow *Pavo*. There are also a few cases of taxa which have alternatively been considered species or subspecies. The very little known Salvadori's Pheasant (*Lophura inornata*) of southern Sumatra differs only slightly in plumage markings from the north Sumatran form *hoogerwerfi*, which has, on occasion, been considered a full species, Hoogerwerf's Pheasant. However, the fact that the male Hoogerwerf's remains undescribed, and that the only two female specimens show very slight differences from female Salvadori's, have failed to convince most authors that Hoogerwerf's merits treatment as a distinct species.

The Vietnamese *Lophura* forms also pose a problem. Very few specimens are known from the wild, and these have been placed into two species, Edwards's Pheasant (*Lophura edwardsi*) and the Imperial Pheasant (*Lophura imperialis*). A third species was proposed from specimens collected in the 1960's. This form was named *Lophura hatinhensis* and has, regrettably, been thus treated as a full species in some quarters, although to date there is insufficient information upon which to accept this as a valid species. It is, at any rate for the time being, better placed within Edwards's Pheasant.

The original multitude of names for the Kalij and Silver Pheasants, the disagreement over the status of the Sumatran *Lophura* forms, and the differences between the few specimens of the genus collected in Vietnam indicate the considerable variation in the dark blue members of the genus and the Silver Pheasant, and at the same time they caution against the erection of new taxa without good evidence. By complete contrast the listing, sequence and composition of the congeneric firebacks and Bulwer's Pheasant (*Lophura bulweri*) are almost universally agreed upon.

Other instances of dispute at the specific level include that of the race *harmani* of the White Eared-pheasant (*Crossoptilon crossoptilon*), which is sometimes considered a full species, Harman's Eared-pheasant. A similar case is that of the Bornean Peacock-pheasant (*Polyplectron schleiermacheri*), which has traditionally been included within the Malaysian Peacock-pheasant (*Polyplectron malacense*); recent investigation

suggests that it is, in fact, a distinct species. Another area of uncertainty is the issue as to whether the Green Pheasant (*Phasianus versicolor*) of Japan is a valid species or a subspecies of the Ring-necked Pheasant (*Phasianus colchicus*). One final issue concerns the Great Argus (*Argusianus argus*) and its race *bipunctatus*, the Double-banded Argus. Whilst the single feather of the Double-banded Argus that resides in the British Museum is clearly from a bird that is closely related to the Great Argus, just how closely the two forms are related is not clear.

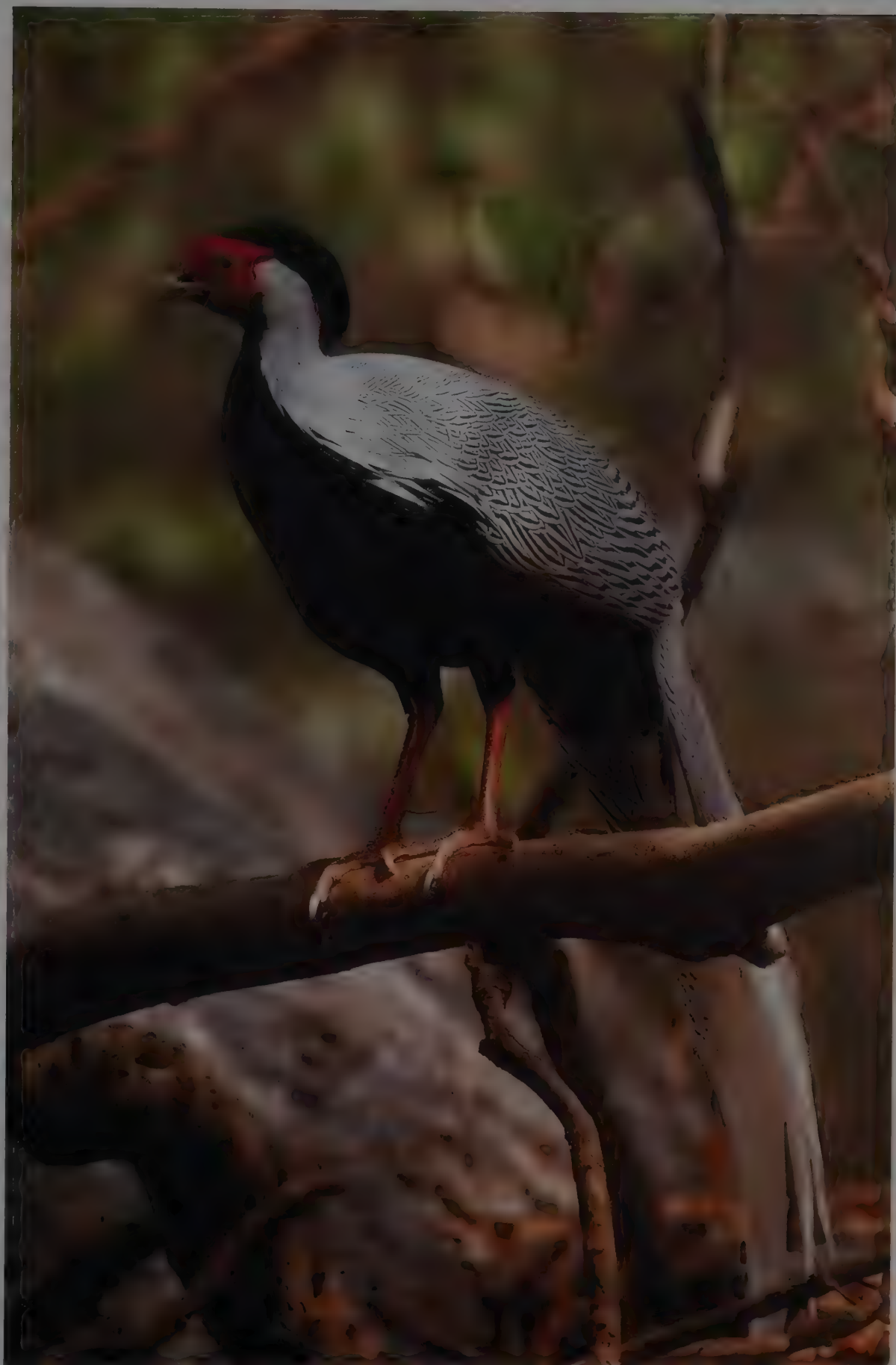
As with the Vietnamese *Lophura* forms, the first two of these issues, referring to the eared-pheasants and the peacock-pheasants, have implications for conservation priorities. After Edwards's Pheasant, the Bornean Peacock-pheasant is probably the most threatened pheasant in south-east Asia, and awarding it specific status does seem to present a clearer picture of the relationship between this form and the Malaysian Peacock-pheasant to the west, and the Palawan Peacock-pheasant (*Polyplectron emphanum*) to the east. Harman's Eared-pheasant, usually considered one of five subspecies of the White Eared-pheasant, is believed to be more at risk than any of the other races (see Status and Conservation). Understanding the relationships between all of these forms is important for species-orientated conservation initiatives.

The decision of which forms to include, and in what order, in the sequence of the *Perdiciinae* is far less clear, and this is a reflection of the greater uncertainty over relationships. This uncertainty has not led to so much controversy, presumably because most authors simply accept that the subfamily is poorly known and that much of the evidence appears to be conflicting. The main doubts seem to refer to relationships among the first few genera in the traditional sequence. The Snow Partridge (*Lerwa lerwa*) is always placed first, but the affinities of *Tetraophasis*, *Tetraogallus*, *Alectoris* and *Ammoperdix* are disputed, and there is generally rather limited agreement between the different authorities. Other issues include the position of the monotypic genera *Ophrysia* and *Anurophasis*, and whether *Francolinus*, *Coturnix* and *Arborophila* should each be split into two or more genera.

The genus *Francolinus* is the one striking exception to the generalization that Phasianidae contains small genera. As wide-

The Silver Pheasant is one of the pheasant species with the greatest geographical variation. In some races, the upperparts of the male are black, finely vermiculated with white, giving a very dark overall appearance. In others, however, they are basically white, with black markings of varying prominence. In the nominate race, these black marks are very narrow, so that white is the dominant colour on the upperparts, giving rise to the species' vernacular name. This male, photographed in Thailand, belongs to the race *jonesi*, which is approximately half way between these two extremes, as the black lines on the upperparts are fairly heavy. The overall appearance of some of the darker races is much more similar to that of some races of the Kalij Pheasant (*Lophura leucomelanos*), than to the whiter forms of the Silver Pheasant. These two species are normally considered to form a superspecies, but the taxonomy of both is far from clear. Some authors have suggested that the Silver Pheasant, with 15 races currently recognized, and the Kalij Pheasant, with nine, should be joined in a single species, as they replace one another geographically. Others propose the division of this complex into several species. The standard division into two species is based, above all, on the colour of the legs, crimson in all races of the Silver Pheasant and grey to brown in the Kalij, and also on the fact that in the former the males do not reach adult plumage until their second year, a year later than occurs in male Kalij Pheasants.

[*Lophura nycthemera jonesi*, Thailand.
Photo: R. Seitre/Bios]





The genus *Perdica*, comprising the four species of bush-quail, is restricted to the Indian Subcontinent. It is normally considered to be closely related to the typical *Coturnix* quails, due to their similarities in general morphological characteristics and in plumage pattern, particularly that on the upperparts. The wings, however, are more rounded, with the fifth, sixth and seventh primaries the longest, whereas those in *Coturnix* are somewhat more pointed, the eighth and ninth primaries being the longest. Within *Perdica*, the Jungle Bush-quail is the species with the strongest preference for stony substrates.

[*Perdica asiatica*.
Photo: Eric & David
Hosking/FLPA]

ly understood, this genus contains 41 species, although whether or not all these forms are best lumped in one genus is still unclear, despite a good deal of attention. Most attempts to interpret how the African and Asian francolins are related to each other have concluded that they are best placed within a single genus, *Francolinus*. Recently, however, T. M. Crowe and his colleagues have analysed 34 morphological and behavioural characters in all 41 species and in some other perdicines, and also restriction-fragment length polymorphisms of mitochondrial DNA of 13 African francolin species and one quail. The results suggest that the genus is composed of four major species assemblages: the five Asian species; two groups of African quail-like species; and the African partridge-like species. Consequently, it has been proposed that the genus be split into four genera, namely *Francolinus*, *Peliperdix*, *Scleroptila* and *Pternistis*. Whether or not this proposal will receive widespread acceptance remains to be seen.

The recommendations to alter the list of the francolins in the standard sequence of birds is based upon efforts to understand their phylogenetic affinities. In essence, Crowe and colleagues suggest that the francolins may not be a monophyletic assemblage as widely thought, for the analysis of morphological and behavioural characters show that the other perdicines included in the study bear more similarity to some francolins than do other francolin species. If, however, the monophyly of *Francolinus* is assumed, then there appear to be two major groups, those that are quail-like, and those that are partridge-like. Again assuming monophyly of the francolins, these workers go on to propose that the genus did not evolve in Asia, as previously supposed. Instead, they suggest that it evolved in Africa and that an early offshoot of the partridge-like francolins reached Asia and then diverged there. This divergence was estimated to have occurred during or before the middle to late Miocene.

The species which now seem to be generally accepted as the constituents of the genus *Coturnix* have, at times, been assigned to a total of three genera, *Coturnix*, *Synoicus* and *Excalfactoria*. In addition, seven, eight or nine species have variously been accepted for this genus.

Nevertheless, it is an understanding of the affinities of the assorted *Arborophila* hill-partridges that probably poses the greatest problems. That there are around 45 forms included in

this genus is not much disputed, but, as these tend to represent widely scattered populations, assessing the relationships between these populations is not easy. The taxonomic status of some forms has been varied by several authors, and the lack of wide acceptance of any one sequence is a clear indication of the need for a fresh approach.

Traditionally, the many forms have been split into 16, 17 or 18 species, comprising one or two genera. Several forms, typically the more northerly ones, are considered monotypic species, but further south there are several instances where the grouping of forms varies extensively, depending on the author. Monotypic species on which there is general agreement include the Collared Hill-partridge (*Arborophila gingica*), the Hainan Hill-partridge (*Arborophila ardens*) and the Orange-necked Hill-partridge (*Arborophila davidi*).

The differences of opinion on how best to treat the genus are greatest concerning the forms that have been alternatively assigned to the genus *Tropicoperdix* on some occasions. These ten forms inhabiting south-east Asian tropical forest do, however, share many morphological features with the other *Arborophila* forms, and are now more generally included within that genus, appearing to constitute one of four subgroups. Determining which of these ten forms are species and which are just subspecies is the most complex problem, and again there is no clear consensus. The most widely accepted version is that these ten forms comprise three species, the Green-legged Hill-partridge (*Arborophila chloropus*), the Annam Hill-partridge (*Arborophila merlini*) and the Chestnut-necklaced Hill-partridge (*Arborophila charltonii*).

Amongst the most exciting ornithological discoveries of the twentieth century have been two new species of Phasianidae, both of which have challenged evolutionary biologists. Both are African species, the Congo Peafowl, which was described for science in 1936, and the Udzungwa Forest-partridge (*Xenoperdix udzungwensis*), described in 1994. The occurrence of a pheasant in the Congo Basin caused considerable surprise to ornithologists, partly because it is such a large bird, but also because it may have Asiatic affinities. Subsequent taxonomic research has produced conflicting results, but it is usually considered more closely related to the peafowl, the two argus species and the peacock-pheasants than to the other pheasants.

Many pheasant species have facial decorations that play an important part in courtship displays.

Particularly striking are the face wattles of some members of the genus *Lophura*, covered as they are in small papillae and with a characteristic velvety aspect. Their colour and form differ from species to species and sometimes from race to race within any one species. In this Crested Fireback of the nominate race, *ignita*, the wattle has a large semi-circular lobe above the eye and a smaller lobe below pointing forwards. In contrast, the paler blue wattle of the race *rufa* has four lobes which are regularly spread around the eye.

[*Lophura ignita ignita*.
Photo: Rod Williams/
Bruce Coleman]



In July 1991, the Udzungwa Forest-partridge was first sighted in East African montane forest. Extensive investigation and comparison suggest that this "new" species is not closely related to other African species, but is a relict form, closest to the *Arborophila* hill-partridges of east Asia. Whilst study of the affinities of this partridge continues, the possible biogeographical implications of these two remarkable discoveries will certainly fuel discussions for years to come.

Morphological Aspects

Pheasants, partridges and their allies constitute a diverse family of small to large terrestrial birds which, nonetheless, share many morphological features. They are ground-dwellers, with squat bodies that are large in relation to the head, bill, short neck, wing and tail, although some pheasants do have long wings and tails. Some of these features are also common to other galliform families, such as the New World quails, but phasianids are generally less morphologically specialized than most of the other groups. For example, they differ from the cracids by lacking the morphological adaptations to living in trees, and they also lack the pectinated toes and feathered nostrils and tarsi of the grouse, the large feet of the megapodes, the mainly bare heads and bony helmets of the guineafowl, the breast adornments of the turkeys, and the serrations on the edge of the lower mandible of the New World quails.

Many of the scientific names of the phasianids do, however, refer to interesting morphological characters. This is especially the case among the pheasants. For example, the generic name of the monals, *Lophophorus*, comes from the Greek *lophos*, "crest", and *phorein*, "to bear", and that of the long-tailed pheasants, *Symnaticus*, is derived from the Latin *symmia*, a robe with a train, which refers to the long tail which is "dragged" behind the male.

There is considerable variation in size among phasianids. Species in the genus *Coturnix* are the smallest members of the family, weighing as little as 43 g, with a wing as small as 6.5 cm, as in the Asian Blue Quail (*Coturnix chinensis*). In contrast, male peafowl are amongst the largest flying birds, and, for example, the Indian Peafowl (*Pavo cristatus*) can weigh 6 kg

and have a wing as long as 50 cm. However, within these extremes most species weigh between 130 g and 2 kg, and have wing lengths of about 11–25 cm.

Males tend to be larger than females, although in some species the size ranges of the two sexes overlap considerably, and in *Coturnix* the females may average slightly larger than males. The stocky body has well developed breast muscles. As flight in most phasianids is restricted to short, strong bursts, large flight muscles are essential to enable the birds actually to become airborne, for short periods of rapid wing flapping.

The bill is usually short and robust, and it is well suited for digging in many species. The monals (*Lophophorus*), for example, have large bills and often dig the ground quite extensively when searching for tubers. The bill is not quite so substantial in some of the tropical forest species, which tend to scratch about among the leaf litter and turn over leaves with the bill, rather than digging in the ground.

The legs are strong, and often relatively short, adapted for the primarily terrestrial life that the species lead, which involves more walking and running than flying. Most species, including those that inhabit open country, prefer to move from place to place by walking, and even to escape by running, only taking to the wing as a last resort or when going to roost. For example, many open country francolins are considered difficult to flush, as they sit tight before suddenly bursting into the air or dashing off on foot.

One of the more conspicuous features of this family is the presence of spurs in the males, at least, of many species. The rear surface of the legs of many phasianids, guineafowl and turkeys often bears a spur, but these are absent from the other galliform families, Cracidae, Megapodiidae, Tetraonidae and Odontophoridae. The spur arises as a bony core towards the base of the hypotarsal ridge on the tarsometatarsus. In a number of species there is more than one spur per leg. For example, in Blyth's Tragopan (*Tragopan blythii*) it has been reported that a second spur can grow from the base of the first. It is more usual, however, for additional spurs to grow separately, emerging from the hypotarsal ridge between the original spur and the top of the tarsus.

The majority of males have one spur per leg, although some species often have considerably more. Male Malaysian Pea-



As its name indicates, the genus *Galloperdix* forms a sort of link between the two subfamilies of the Phasianidae: the partridges and their allies (including *Galloperdix*) of the *Perdicinae*; and the pheasants of the *Phasianinae*. Certain features visible in this male Red Spurfiowl are reminiscent of pheasants, such as the length and shape of the tail and the fairly large area of bare facial skin. Note also the tarsal spurs, which are particularly numerous in this genus, with up to three on each leg in males, and up to two per leg in females.

[*Galloperdix spadicea*.
Photo: Kenneth W. Fink]

cock-pheasants, for example, usually have two spurs per leg, but a total of seven has been recorded, three on one leg and four on the other. Indeed, the generic name *Polyplectron* is derived from the Greek, and means "many-spurred". Females, as well as males, of a few species possess spurs, such as all three spurfiowl (*Galloperdix*) of south Asia.

The function of the spurs has received surprisingly little attention. It seems not unreasonable to suppose that the spurs are primarily weapons used in combat between ground-dwelling males. However, it has recently been claimed, rather controversially, that the presence of these spurs has nothing to do with competition among males; instead, it is suggested that a female chooses her mate on the basis of the length of the spurs. The role that the spurs play in the life of those females that possess them is even more uncertain.

Among the pheasants in particular, the presence of a variety of facial adornments in the males is striking, whereas most of the partridges, quails, francolins and snowcocks lack such crests, wattles, ruffs and hackles. These specialized structures are used in courtship displays before females, and also, in some cases, during aggressive interactions with other males. Wattles and lappets are present in some members of *Tragopan* and *Lophura*, and are either not visible or much reduced when the male is not displaying. Facial wattles are most pronounced in the male Bulwer's Pheasant. Most of the time, the sky blue wattles almost cover each side of the face, and rise slightly above and hang just below the level of the head. When engorged during display, however, they can be extended down the neck to such a degree that they reach the back and also right down below the head, in the form of an arc, some 18 cm in length. All of the tragopans possess lappets, which are usually much reduced and inconspicuous. When the bird displays frontally, the lappet hangs down and is spread out, revealing bare skin that is often brightly patterned.

Crests, "horns" and ruffs, in contrast to wattles and lappets, are composed of feathers. Crests are found in a variety of species, of both partridges and pheasants, including the Crested Wood-partridge (*Kallulus rotundus*), the Kalij Pheasant and the peafowl. Horns are feathers which arise from each side of the head and are found in *Pucrasia* and *Tragopan*. The "ears" of *Crossoptilon* are similarly elongated feathers. Ruffs are found

only in the genus *Chrysolophus*, and these two species are commonly known as the ruffed pheasants. In some species, such as the Indian Peafowl, the crest is evident at all times, whereas in others, such as the Malaysian Peacock-pheasant, the crest is only erected during display. The ruffs of the male Golden Pheasant (*Chrysolophus pictus*) and Lady Amherst's Pheasant (*Chrysolophus amherstiae*) are fully expanded during display, when they form a semi-circle of feathers around and below the eye.

Many pheasant species have long been kept in captivity, because of the extravagant plumage patterns, usually of males, which have led to their being considered "ornamental". Among the partridges, quails, francolins and snowcocks, brightly coloured males are less common. As with the aforementioned wattles, crests and so on, the extravagant plumages have been assumed to play an important role in courtship, reflecting the reproductive pattern of the species concerned. Whilst some of the males are visually spectacular, the majority of females in this family can be described as cryptically patterned, in a combination of browns, greys, black and white. The result is a considerable degree of sexual dimorphism in some species, although this aspect varies quite remarkably across the family.

Two studies have investigated how the variation in the degree of sexual dimorphism throughout the whole order Galliformes might be correlated with various aspects of ecology and reproductive behaviour. H. Sigurjónsdóttir found that the greater the difference in size between males and females, the greater the difference in colour dimorphism as well. Generally speaking, males that are large and brightly coloured tend to help little in the raising of young, compared with those in the less dimorphic species. Sexual dimorphism was related to aspects of ecology and breeding behaviour by M. Ridley, who found that both size and colour dimorphism tended to be least pronounced in monogamous species. Forest inhabitants also seem to be both larger and more brightly coloured than those in open habitats, such as grassland.

Chicks are precocial, and vary in colour from pale sandy buff through to a range of browns, often with distinct dark markings, such as stripes, bars and patches. In many species, immatures resemble the adult female in patterning, but shading varies. Post-juvenile moult, at any rate in Western Palearctic

species, is complete, and, except in a few pheasants, males assume adult plumage in the first year.

The sequence of the moult of the tail feathers was proposed as a method of dividing the Phasianidae into four subfamilies, by W. Beebe in 1914. In essence, he found that there are four different sequences of tail moult in this family. Although he was not able to inspect all the genera, he suggested that, in the Old World partridges, quails, francolins and snowcocks, the Blood Pheasant and the tragopans, moult begins with the central rectrices and proceeds outwards. Conversely, in most of the pheasants, the sequence is from the outermost tail feathers inwards. In the argus pheasants (*Polyplectron*, *Argus*, *Rheinardia*), however, moult begins with the third feather on either side of the central pair and moves both inward and outward from this point. The fourth mode is that of the peafowl, in which the pair of feathers that are second from the outside are shed first and moult progresses inward, while the outermost pair fall just before the innermost ones.

The timing of moult in most Western Palearctic species is well known. All species undergo a complete post-breeding moult, the timing of which varies according to sex and locality. For example, the onset of moult in the Chukar (*Alectoris chukar*) is variable, depending upon when the breeding attempt is completed; females moult a little later than males. Transcasian populations of the See-see Partridge (*Ammoperdix griseogularis*) begin earlier than those further south in Iran and Afghanistan, but in most species in the region, moult is usually under way by May-July and completed by October-November. Much less is known about the timing of moult in wild populations of most other phasianids, but in the Great Argus of south-east Asia, moult appears to start between mid-May and the beginning of July, and may possibly last for 125 days; this approximation has been based on the finding of feathers on the forest floor.

Habitat

As most species in this family are fairly sedentary, or completely so, they use the same habitat throughout the year, and do not utilize separate areas for different activities, such as nesting, or feeding.

The two subfamilies in the Phasianidae show quite different patterns in their distribution and, therefore, habitat use. The pheasants, Phasianinae, are exclusively Asian in distribution, with the single exception of the Congo Peafowl. Several species have been introduced into Europe, North America and Australia, particularly the Ring-necked Pheasant, but also the Red Junglefowl (*Gallus gallus*), along with local introductions of a few species, such as the ruffed pheasants. Their natural distribution in Asia takes them from Java at 8° S, where the Green Peafowl (*Pavo muticus*) and Green Junglefowl (*Gallus varius*) occur, through the equatorial forests of Malaysia to Indochina and China, where the Koklass Pheasant (*Pucrasia macrolopha*), Reeves's Pheasant (*Symaticus reevesii*) and the Blue Eared-pheasant (*Crossoptilon auritum*) are amongst the most northerly species in the subfamily, at 50° N. Excluding the Congo Peafowl, the westernmost member of the subfamily is the Ring-necked Pheasant in the Caucasus, and pheasants occur along the Himalayas and eastwards to the Pacific Ocean, in Japan, where the Green Pheasant and the Copper Pheasant (*Symaticus soemmerringii*) can be found.

As with the pheasants, the distribution of the partridges, quails, francolins and snowcocks is centred on Asia, but it extends throughout much of the Old World. The south-eastern limit is found in Australia and Tasmania, given that the New Zealand Quail (*Coturnix novaezelandiae*) is now extinct (see Status and Conservation). Thence the group extends northwards through New Guinea, south-east Asia and China to nearly 60° N, where the Japanese Quail (*Coturnix japonica*) and the Tibetan Partridge (*Perdix hodgsoniae*) are found. Westwards, the group is distributed through south-east Asia, where *Arborophila* and several single-species genera occur, including the Crimson-headed Partridge (*Haematoryx sanguineiceps*), to the Indian Subcontinent.

Though basically ground-dwellers, many phasianids perch in trees or bushes when calling, especially in the early morning or late afternoon. This behaviour is more common among species that live in open habitats, such as the Grey Francolin. This species also has the habit, unusual for a francolin, of roosting in trees at night, and two birds will sometimes roost in close bodily contact. This species is very popular as a cage bird, partly due to its loud, ringing calls, which it makes throughout the year. In Pakistan, in the province of Sind alone, thousands of permits are granted every year to catch birds for this trade. Despite this pressure, it is still the commonest resident gamebird over most of its range, as a result of its high breeding potential and remarkable adaptability.

[*Francolinus pondicerianus interpositus*, Ranthambhor National Park, Rajasthan, India. Photo: Günter Ziesler]





The Snow Partridge's disruptive plumage pattern, mainly produced by the finely barred head, neck and upperparts, is highly cryptic, and provides very effective camouflage in its high altitude habitat which abounds in lichen-covered rocks. This is a monogamous species, in which pairs form a lasting bond, so in spring it is commonly found in pairs. Following breeding, however, flocks may form, with up to thirty birds coming together.

[*Lerwa lerwa*, Sagamatha National Park, Nepal.
Photo: Dieter & Mary Plagel]

which is home to the spurfowl (*Galloperdix*) and bush-quails (*Perdicula*) amongst others. Further west, the subfamily is represented in the Middle East by several genera including *Ammoperdix*. In Africa, most species in the large genus *Francolinus* are to be found, and in Europe *Perdix* and *Alectoris* occur. The group is absent from Saharan Africa, extreme northern Europe, northern Siberia and the Australian interior.

As might be predicted from the extensive area inhabited by the phasianids, the various species use a considerable

range of habitats. The pheasants mainly occur in forested or semi-forested habitats, ranging from ever-wet tropical forests to temperate scrub forest, although the Cheer Pheasant (*Catreus wallichii*) is an inhabitant of grassy hillsides with scattered crags.

Perdix gamebirds can be found in virtually every terrestrial ecotype, being absent only from tundra and boreal forest, where they are replaced by the Tetraonidae. They occur in both open country and closed habitats. Open habitats in which these species are found include a wide variety of tropical and temperate vegetation types, from deserts to montane pastures. Many species occur in tropical plains or savannas, for instance the Grey-breasted Francolin (*Francolinus rufopictus*) of East Africa, while temperate and steppe grasslands of Europe and northern Asia are home to the Grey Partridge amongst others. Philby's Partridge (*Alectoris philbyi*) of western Arabia is one of the relatively few species that occur in the desert, whereas high altitude alpine zones support several species, including the Tibetan Snowcock (*Tetraogallus tibetanus*) of the Pamir and Himalayan Ranges. At the other extreme, perdixines are found in forested habitats, such as the lowland tropical rain forests used for example by the Crested Wood-partridge of south-east Asia and Latham's Francolin (*Francolinus lathamii*) of Africa. The Red-billed Hill-partridge (*Arborophila rubrirostris*) of Sumatra inhabits montane tropical forest, and subtropical forests are also home to several species, including the Sichuan Hill-partridge (*Arborophila rufipectus*) in south-western China.

Phasianid habitats are distributed from the lowlands up to high alpine meadows in both temperate and tropical areas. The family occupies mountain slopes throughout its range, such as the Caucasus, where the Caucasian Snowcock (*Tetraogallus caucasicus*) can be found; Mount Elgon and the Aberdares in East Africa, which are home to Jackson's Francolin (*Francolinus jacksoni*) and the Moorland Francolin (*Francolinus psilolaemus*); and the Himalayas in Asia where several species occur, including the Koklass Pheasant and the Chestnut-breasted Hill-partridge (*Arborophila mandellii*). In the Himalayas and western China, pheasants and partridges can be found above 4000 m in the summer and the Chinese Monal (*Lophophorus thuyii*) may not even descend much lower dur-

In common with the tendency in many other bird groups, those partridges that inhabit the interior of tropical forests generally have brighter plumage than those of more open habitats. A case in point is the Ferruginous Wood-partridge of the Malay Peninsula, Sumatra and Borneo, with its bright rusty brown head and breast, its black and white mantle and the ocellus-like black spots on its wings.

[*Caloperdix oculea*.
Photo: Morten Strange/
NHPA]



ing the winter. The snowcocks (*Tetraogallus*) are found up to the permanent snow-line which may be above 5000 m in some places.

Because not all habitats are equally widespread, the species which inhabit them have ranges that vary similarly in size. The relationship between habitat type occupied and the area of a species' range has been assessed for the francolins of Africa. There are many more francolins living in open areas in Africa than there are occupying forest and forest edge habitats; species of the latter habitat have ranges averaging about 100,000 km². For example, Nahan's Francolin (*Francolinus nahani*) is estimated to have a range of about 95,000 km², and the Handsome Francolin (*Francolinus nobilis*) of about 134,000 km². The non-forest species, however, commonly occupy areas greater than this, and many cover 1,000,000 km² or more, such as the Coqui Francolin (*Francolinus coqui*), which is distributed over more than 4,000,000 km², and Swainson's Francolin (*Francolinus swainsonii*) which covers about 1,500,000 km². This relationship has not been studied critically throughout the whole family, but it does appear to apply broadly. Many species of both pheasant and partridge inhabiting south-east Asian rain forest, for example, have distributions of less than 100,000 km². In contrast, most of those living in the grasslands, plains and semi-arid ecosystems of the Palearctic and Africa have ranges greater than this, and many are considerably larger than 500,000 km².

Species which occupy climax habitats, such as mature forests, are typically restricted to these areas, whereas some of those that occur in non-forested habitats live in a range of vegetation types. For example, the Double-spurred Francolin (*Francolinus bicalcaratus*) is found in a wide range of open habitats in Africa, from moist savanna to arid savanna, and including a variety of forms of cultivation and moist Mediterranean vegetation near the coast. Similarly, Swainson's Francolin, while preferring dense grassland, also lives in thornbush with sparse cover, bushveld and along the edges of woodland.

At a fairly general level, the type of vegetation that each species uses is well known in most cases. As more studies are conducted at a finer scale, that of the micro-habitat, however, it is becoming apparent that some phasianids show very par-

ticular patterns of habitat use. Once a species has been recorded in a certain habitat type, it has been common practice to assume that it occurs throughout the range of that particular vegetation type. But now this convention is being revised in several cases. For example, it is now known that Malaysian Peacock-pheasants do not use all parts of the primary lowland forest in which the species is found in Peninsular Malaysia; it uses areas by slow meandering rivers and those that are less disturbed by tree-falls. It also appears to have particular requirements when it comes to making display scrapes, choosing parts of the forest near seasonal inland swamps. Consequently, the area really inhabited by the species is probably much smaller than originally thought, as it may be patchily distributed throughout the lowland forest.

Similar studies have shown that the Cheer Pheasant is restricted to grassland in early stages of succession on mid-altitude slopes of the western Himalaya, and that during the winter Cabot's Tragopan (*Tragopan caboti*) preferably uses the patches of forest that contain more of the nut-bearing tree *Daphniphyllum macropodum*. The patterns of habitat use of the Ring-necked Pheasant in its introduced range probably constitute one of the most intensively studied subjects in the family. In the managed woodlands of southern England, female density is highest where there are more shrubs, whereas male density is highest where there are more food hoppers, and also in the woodlands with the greatest length of edge. In spring, both sexes are found close to the woodland edge, feeding in fields on the one side and nesting in the woodlands on the other, although later on in the breeding season, females nest in tall cereal crops as well.

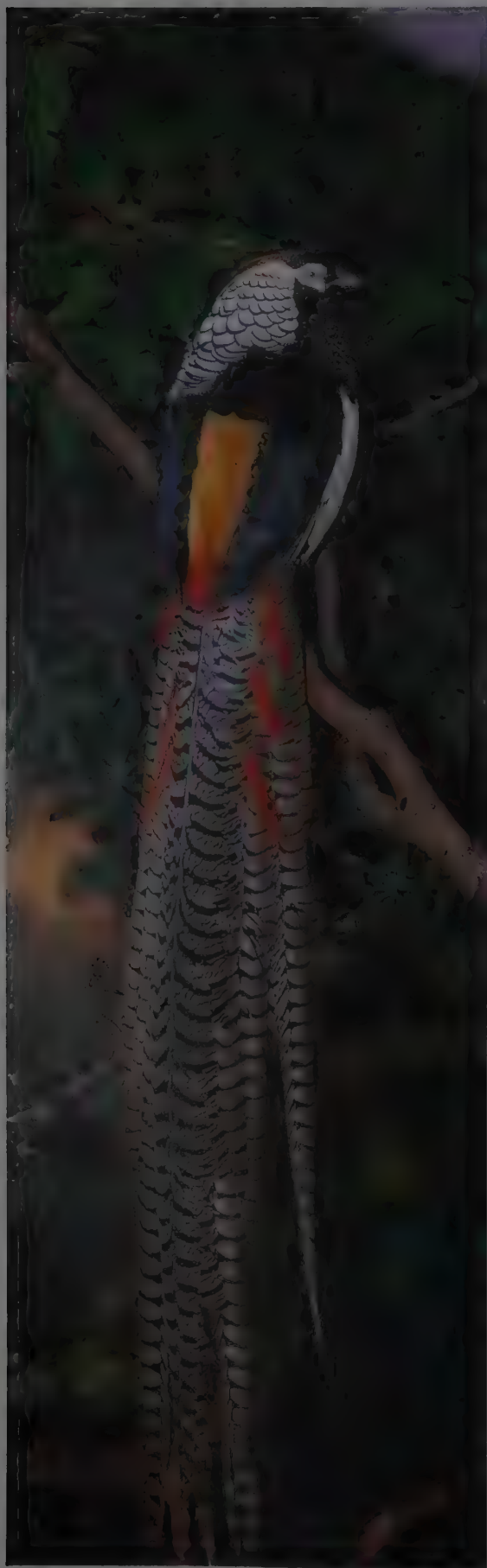
General Habits

There is considerable variation in the group size in which phasianids occur, both throughout the family and within some species between seasons. Individuals of both sexes in some species are believed to remain solitary throughout the year. Several pheasants in south-east Asia are not known to associate with conspecifics for any length of time at all, the two sexes meeting only to copulate, as in the Great Argus and the Crested

Of the many ornamental features which make male pheasants so spectacular, one of the most notable is the extraordinary growth of certain feathers in some species. The male Great Argus, for example, has remarkably long central tail feathers, four times the size of the outer feathers, and extremely long, broad secondaries, which far exceed the primaries in length. In addition, each secondary is decorated with a chain of up to 20 large golden ocelli, which are most effectively displayed during the astonishing courtship dance. In normal circumstances the ocelli remain concealed, however, making the plumage appear much duller, and even cryptic against the background of the forest floor.



[*Argusianus argus argus*.
Photo: Eric & David
Hosking/FLPA]



Argus (*Rheinardia ocellata*). In contrast, many open country species are often found in larger groups, at least outside the breeding season, and often in pairs whilst breeding. Some of the African francolins, such as the Grey-winged Francolin (*Francolinus africanus*) of South Africa, form groups of up to 15-20. There are also reports of eared-pheasants (*Crossoptilon*) in China occurring in flocks of up to 100 birds during the winter.

It has been suggested that group size in phasianids is a compromise between protection from predators and conspecific males, on the one hand, and access to mates, on the other. In this proposal, males guard the females from predators and the unwanted attention of many other males of the same species, in return for exclusive mating opportunities. This is particularly important in open habitats, where there is less concealing vegetation and the male-female bond is prolonged, either in a pair, as in the Swamp Francolin (*Francolinus gularis*), or in a harem, if the females are gregarious during the breeding season, as is the case in the Ring-necked Pheasant. In closed forest habitats, where females can be concealed by vegetation, males do not need to guard them, and as a result many more species are solitary, for instance the Palawan Peacock-pheasant. There are exceptions to this generalized scheme, such as the Crested Fireback (*Lophura ignita*), an inhabitant of primary rain forest, which can be seen in flocks of up to ten individuals.

As already suggested, the degree to which some species are gregarious varies through the year. Whilst during the non-breeding season a number of phasianids are to be found in groups, these tend to disperse during the breeding season. For example, the Double-spurred Francolin occurs in groups of up to 12, or even 40, individuals, but is found almost invariably in pairs immediately before and during the breeding season. Also, in the monogamous Cheer Pheasant, it is reported that several pairs will join together to form a single flock during the winter.

The daily routine of phasianids generally follows a simple pattern. After emerging from the roost, birds feed, before retiring to shelter during the middle of the day, reappearing to feed in the late afternoon. Many open country species, for example the Chukar, feed in open areas in the early morning, before retreating to patches of scrub, to dense areas of long grass or under rocky ledges; late afternoon foraging in this species is often conducted near water. The daily activities of forest phasianids are very little known. Radio-tracking of a few Malaysian Peacock-pheasants revealed that birds were mobile for much of the day: there was no predictable midday resting period. Conversely, the male Great Argus was found to spend some time sitting on low branches near dancing grounds during the day. For at least part of the year many phasianids, primarily the males, start the day by calling. In open country this calling is often from atop rocky outcrops or perches in trees or bushes. Some forest species, such as the Malaysian Peacock-pheasant and the Satyr Tragopan (*Tragopan satyra*), are known to call from elevated branches 10-20 m off the ground.

Whilst the way in which phasianids spend their day in some habitats and situations is broadly known, detailed daily activity patterns are understood in only a few species. In southern England, the time budget of feral Red Junglefowl differs between the sexes during spring. Both sexes sit, stand, are vigilant, walk, preen, search for food whilst walking, scratch and peck at food, and engage in interactions. While males spend more of their time (37%) standing than in any other activity, females spend only 12% of their time simply standing. Nearly half of the females' time (47%) is spent feeding by scratching and pecking at food, whereas this activity accounts for only 14% of the males' time. When the females are with young, they also brood the chicks and spend nearly 60% of their time scratching and pecking at food.

Imprinting and social dominance are two aspects of behaviour that have been well studied in this family, or more specifically in domestic fowl. These traits are well developed in phasianids because of their lifestyle, in which imprinting and the establishment of peck orders play important roles. Filial imprinting begins virtually at hatching, and, under natural con-

In the cock Lady Amherst's Pheasant, the tail feathers are remarkably long, measuring at least 100 cm, and sometimes more than twice the length of the head and body. This species is also a good example of the richly varied colouring of some cock pheasants' plumage. Various shades of red, orange, yellow, green, blue, brown, grey, black and white are all present in this marvellous bird. The large ruff of rounded feathers starting from the nape is spread like a fan around the head and neck during courtship display, when the small wattle under the eye, clearly visible in this bird, is expanded into a lappet covering the lower part of the cheek. The species was described in 1829 from two cocks sent to London by Lord Amherst, both of which died shortly after arrival. Later imports of birds, from 1869 onwards, rapidly led to the species being well established in captivity in Europe, and, as a consequence of its beauty and the ease with which it is kept and bred, it soon became a favourite with aviculturalists.

[*Chrysolophus amherstiae*. Photo: Kenneth W. Fink]

All pheasants, as well as the vast majority of the other members of the family, are very poorly adapted for long sustained flight. They do, however, have powerful pectoral muscles, which allow them to take off rapidly and thus escape danger, at times when running away is not sufficient. The longest recorded non-stop flight by a Ring-necked Pheasant was of 6.5 km, in order to cross water. This is exceptional, however, as many birds have fallen, exhausted, into water when trying to perform much shorter crossings.

[*Phasianus colchicus*.
Photo: Gary W. Griffen]



ditions, ensures that the precocial chicks follow the parent rather than other moving objects, such as another bird species or mammal. In the *Coturnix* quails, sexual imprinting, the process of learning the characteristics of the species, is highly specific, and individuals prefer mates that are similar, but not identical, to their immediate family. This results in mating with distant relatives rather than siblings or unrelated birds.

In social phasianids, the peck order, or dominance hierarchy, within a group is considered a mechanism for social integration. Both Red Junglefowl and Ring-necked Pheasants have linear hierarchies, and there is anecdotal information that suggests that dominance patterns occur in other pheasants and partridges. For example, it appears that dominant male Double-spurred Francolins lead groups, exceptionally of up to 40 birds, as they wander through open vegetation.

Voice

The crow of the domestic or village cock is one of the most familiar natural noises the world over. What may not be such common knowledge is the fact that the Red Junglefowl, most likely the wild ancestor of the domestic chicken, has an extensive vocal repertoire, which is rather well known compared with those of other phasianids, and indeed of most other birds. Many other pheasants, partridges, quails, francolins and snowcocks also have very conspicuous calls, and in some cases their calls are particularly evocative of the areas within which they live. For example, the far-carrying wailing cry of the Great Argus is one of the most distinctive sounds of the rain forest covered hills in the lowlands of Malaysia and Indonesia, and likewise the harsh call of the Koklass Pheasant is typical of dawn on cool spring mornings in the mid-altitude forests of the western Himalayas.

Pheasants, partridges and their allies have a wide range of calls, with which they communicate in a great variety of situ-

ations. Advertising calls, contact calls, alarm calls and contentment calls are among the vocalizations described for these birds. They range from sounds audible to the human ear only at a few paces, to others, such as that of the male Crested Argus in the breeding season, that can be heard for several kilometres. Some calls are given throughout the year and others only during the breeding season, depending upon the species, context and function.

Fairly complete repertoires have been described for several species. In addition to the case of the Red Junglefowl, the calls of the Grey Partridge, the *Alectoris* partridges, the Cheer, the Kalij and Lady Amherst's Pheasants, the Malaysian Peacock-pheasant and the Great Argus, among others, have been quite fully described. Only in a few species, however, has the function of the calls been adequately explored.

There is considerable variation in group size among phasianids both according to species, and in some cases time of year or habitat (see General Habits). As calling is a major channel of communication between individuals, it is no surprise that the vocal behaviour of the phasianids reflects this diversity of social patterns. So, on the one hand there are species which are believed solitary and for which few different calls are known, such as the Great Argus, and on the other extensive vocal repertoires are reported for some gregarious species, most notably the Red Junglefowl. It should be stressed, however, that knowledge of sounds made by phasianids still remains very patchy. The calls of most northern temperate species have been documented, and, in many cases, their function implied or demonstrated experimentally, whereas knowledge of most other species is restricted, at best, to descriptions of some of the louder calls. Therefore, any account inevitably relies on well studied cases for examples; these should not be taken as exhaustive lists.

In the largely solitary species it appears that vocal communication is mostly used by males during the breeding season, when they give loud advertising calls and also emit quiet noises



As one would expect for such eminently terrestrial birds, phasianids have strong legs that are well adapted for walking and sometimes running, often over broken terrain. The bushy reddish occipital crest, the glossy bluish black plumage, the bright red base of the bill and bare skin around and behind the eye, make the male Crested Wood-partridge one of the most striking of all the *Perdicinae*. This species, an inhabitant of the tropical forests of south-east Asia, shows notable sexual dimorphism; unusually, the plumage of the female is not cryptic, but instead is predominantly bright grass green.

[*Rollulus rouloul*.
Photo: Josep del Hoyo/
Lynx]

during close contact, which may be in courtship display to females or in aggressive encounters with other males. Females of these solitary species appear to be far less vocal, and why they should, occasionally, make loud calls is not at all clear. Gregarious species, whether they form winter flocks of birds of breeding age, or are family coveys remaining together until the young reach their first breeding season, have much larger repertoires. This reflects the greater social contact that individuals have and the variety of contexts in which communication is required, such as for keeping the flock together, alerting others to the proximity of potential predators and reassembling when the group is split.

The calls themselves vary considerably in structural features, such as frequency, duration and amplitude, and it is worth briefly describing some of these vocalizations with reference to their contexts and functions.

Many of the calls given by species which flock are quiet noises, important only within the group context. Hence they only need to be audible over a few metres so that other flock members can hear; good examples are the contentment notes emitted by the Red Junglefowl and the contact calls of Grey Partridges. These are probably different names for calls which serve a similar, if not identical, function. Both have harmonically complex structures, at least in part, and are primarily of low frequency. The contact call of the Grey Partridge comprises two types of note, two short, wide frequency notes given far apart, followed by a short series of narrower frequency notes emitted rapidly. The contentment call of the Red Junglefowl, in contrast, is a simple series of similar calls. In both species, the calls are uttered by both sexes and can be heard during activities such as feeding, cleaning, sand-bathing and resting, and they seem to function as group cohesion or social contact calls. Feeding flocks of Caspian Snowcocks (*Tetrao gallus caspius*) also call continually to one another. Most of the species which form coveys are known to give contact calls, including the See-see Partridge, the Còqui Francolin, the Scaly Francolin (*Francolinus squamatus*), Hartlaub's Francolin (*Francolinus hartlaubi*), the Crested Wood-partridge and the Blood Pheasant.

If individuals in a covey have been separated, they typically re-establish contact with rally calls. In the Grey Partridge these

are given by both sexes at all ages. Individuals emit the call alternately, when standing upright and with the neck outstretched. The call is of higher frequency than the contact call in this species, most of the sound being between 3.2 and 4.8 KHz. Structurally, each note usually comprises three elements, although the second can barely be detected or is even absent in some cases. After being dispersed, Blood Pheasants give loud, shrill calls of three to seven notes, which serve to bring members of the covey back together. It is possible that whilst birds are attracted to calls from others in their covey, they are repelled when the rally call is given by individuals from other coveys. Other species in which covey re-formation in this way has been documented include the *Alectoris* partridges, the Crested Wood-partridge and the Jungle Bush-quail (*Perdica asiatica*).

In some species, the contact and rally calls serve to maintain and re-establish contact between parents and chicks, as well as among adults. In these species, and those which are largely solitary, there are also vocalizations that are used only when parents are with their offspring. These may be termed "family calls", and include several utterances given in different circumstances. Grey Partridge parents, for example, hiss when a potential predator appears, one parent gathering the young together, and the other approaching the intruder aggressively, hissing all the while. Female Rock Partridges (*Alectoris graeca*) repeatedly utter monosyllables when feeding with chicks, and these notes escalate into phrases when the females try to draw their chicks to new food sources.

Communication between adults and young begins even before the eggs hatch. A study of Ring-necked Pheasants showed that chicks exposed to vocalizations made by an incubating female during the last week of incubation differed in their behaviour, during the first week after hatching, from those chicks incubated in silence during the last week. Responses to feeding and caution calls made by the adult female were stronger in those chicks that were exposed to incubation calls than those incubated in silence. An interpretation of this is that the calls of the incubating female serve to make chicks familiar with these important calls immediately upon hatching, thus enabling them to act appropriately at an extremely early stage. Synchronous hatching may also be promoted by

Areas of rich grass cover, such as open grassland and savanna, are the preferred habitat of Shelley's Francolin. Unlike the phasianids that inhabit mature forests, and are normally tightly restricted to them, those species that live in open areas generally use a wider range of habitats. Shelley's Francolin can also be found in thornveld, clearings in woodland, stony or rocky terrain and locally even cultivation. It can be found from coastal areas to mountains, up to at least 3000 m.

[*Francolinus shelleyi shelleyi*, Kenya.
Photo: Juan Manuel Borrero]



communication between chicks during the latter stages of incubation.

Other vocalizations used between adults in groups include dominance and submissive calls, such as the peeps and squeals of the male *Alectoris* partridges, and low frequency, harsh threat calls issued by dominant Red Junglefowl to submissive individuals. Chicks also emit contentment notes when they are untroubled, as reported in *Alectoris* partridges, the Ring-necked Pheasant and the Common Quail (*Coturnix coturnix*).

Alarm calls are typically loud and harsh-sounding to the human ear. These include those that are given when individuals in forested habitats are disturbed by an intruder some distance away, as occurs in the Palawan Peacock-pheasant, and also those uttered when a bird "explodes" into the air in more open country, as is typical of the Grey Francolin (*Francolinus pondicerianus*). Calls which have been interpreted as alarm calls are given by both solitary and gregarious species. The Malaysian Peacock-pheasant, essentially a solitary inhabitant of primary lowland rain forest in south-east Asia, at some times of the year gives alarm calls whilst still some distance from an intruder. These calls are explosive noises of wide, and essentially low, frequency; each call may constitute many notes and can be repeated many times. In contrast, some other gallinaeous inhabitants of the same area are rarely heard at all. The gregarious *Alectoris* partridges and Lady Amherst's Pheasant are among those which have a variety of vocalizations that are used in distress situations. In *Alectoris*, these include: a ground alarm call, a shrill whistle which is uttered when flushed; a hawk alarm call, a short, guttural sound given when an aerial predator comes into view; and a loud, shrill scream that is given when a bird is attacked suddenly.

During the breeding season, males of many species use vocalizations that are heard only at this time of year and include advertising and courtship calls. It is the advertising calls that have tended to attract most attention, as they are typically loud and far-carrying, and are usually referred to as territorial, crowing and female attraction calls. In open country habitats, many males move to conspicuous positions to make these calls. Male Scaly Francolins, for example, use termite mounds and similarly exposed positions to call from,

and Himalayan Snowcocks (*Tetraogallus himalayensis*) often perch atop mounds, rocks, trees and bushes. The Double-spurred Francolin, which also inhabits non-forested areas, likewise gives its harsh, grating advertising call from prominent positions. The notes are principally of low frequency, with most energy emitted below 3 KHz, and notes repeated about every half second.

In the solitary, forest-dwelling Malaysian Peacock-pheasant and Great Argus, there appear to be two types of advertising call. In the former species, these "tchorrs" and whistles carry for up to 300 m through the forest undergrowth. The calls verbalized as "tchorrs" are harsh-sounding, and each call contains a single note of narrow frequency range, usually below about 2 KHz, and lasting between half a second and a full second. Whistles are a melancholy double note call, the second note of higher frequency than the first. They are also of narrow frequency range, although, at less than 1.2 KHz, they are lower-pitched than the "tchorrs". Both calls are often repeated many times, and both are sometimes heard in the same bout, in which case "tchorrs" are always emitted first. It has been suggested, from observation, that the number and type of calls given by a male indicate his reproductive condition.

The two advertising calls of the Great Argus are similarly of low frequency, and are often given from near the top of low hills. These calls are amongst the most evocative sounds of the south-east Asian rain forest, and they can be heard as much as a kilometre away.

The daily pattern of calling during this period typically has a peak around dawn, and in some species a secondary peak at dusk. This has been qualitatively stated for many *Francolinus* species, and there are limited data for the Swamp Francolin which show a peak around sunrise and sunset. Male Koklass Pheasants chorus in the early mornings from November to June, just as first light appears in the sky. Chorusing appears unaffected by the weather, and usually lasts about half an hour, finishing before sunrise. The Cheer Pheasant, which also occurs in the Himalayas at mid-altitudes, choruses at dusk as well as dawn. Both sexes of this monogamous species participate in the chorus, the paired male and female usually calling together in such a way that it sounds as if only one individual is giving a very complex call. First calls are usually given an hour or

less before sunrise, and may, on occasion, last up to an hour after it. In the evening, the chorus typically lasts from up to an hour before sunset to half an hour afterwards.

As these sounds are conspicuous to the human ear, they are often the first indication that a particular species is present in a given area. Therefore, knowledge of these loud calls provides the most ready form of identification in many circumstances and is an important survey technique when searching for many species which are little known or difficult to detect. This has proved especially valuable in the cases of the Koklass and Cheer Pheasants.

Other breeding season vocalizations that have been described include nest and courtship feeding calls and post-oviposition cackling. Nest calls are given by some females when on the nest, as in the Rock Partridge, these are soft notes that rise and fall. Courtship feeding calls are emitted by most species and are believed to result from "stimulus contrast", whereby novel food items elicit a greater response than do familiar ones. There is relatively little variation among pheasant species in the structure of this feeding call, while there is more diversity in form among the partridges, quails and francolins. Although it might be expected that, as a short range call, there might not be much need for species-specificity in these calls, it has been suggested that such differences that do exist throughout the family as a whole are the result of selection pressures arising from the body size of a given species and the habitat in which it lives.

The post-oviposition cackle of the female Red Junglefowl is believed to incite competition between males for the female. The cackling, usually uttered within an hour of laying, is believed to coincide with ovulation and, by inciting competition between males, it appears that dominant males may be most likely to fertilize the eggs.

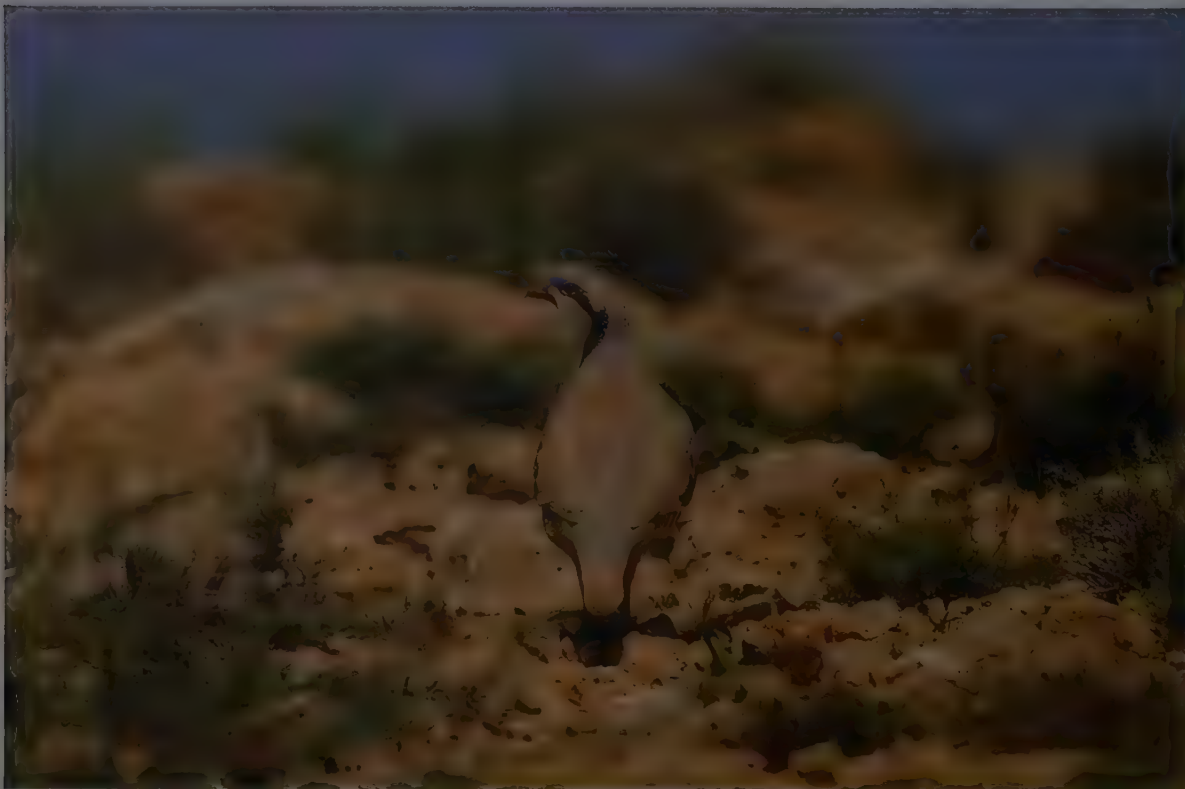
As well as this array of vocal signals, some phasianids also make noises by flapping their wings rapidly. "Wing-whirring", as it is known, appears to be designed to create sound, and is used during courtship display by male gallo-pheasants (*Lophura*). The level of sound produced by this display varies, at least in the Crestless Fireback (*Lophura erythrophthalma*), and may be virtually inaudible at five metres, or may carry up to 30 metres.

Food and Feeding

There is considerable variation among the phasianids in terms of diet. Kinds of food eaten vary between groups and also by season, and even by habitat in some species, but in most cases food is found just above or below ground level. Food taken includes a wide variety of seeds, leaves, flowers, stems, buds, tubers and roots of different plants, and many animals, from larval forms through invertebrates to small reptiles, in some cases. Whilst there is much information on the diet of phasianids in Europe, including introduced populations, and in some instances in South Africa, detailed data are lacking for most other areas. In these latter regions, such as the Himalayas and south-east Asia, all that is known is what has been gleaned from occasional observations and what has been found in the stomachs of birds shot, usually by the sporting naturalists of times gone by. Hence, all that is known about the diet of Finsch's Francolin (*Francolinus finschi*) is that it includes beetles, insect larvae and seeds, while the food of the Moorland Francolin is not known at all, although it is expected to consume mainly bulbs and roots in a mixed diet. Very little, if anything, is known about the feeding habits of most galliform inhabitants of south-east Asia's forests, such as the Brown-breasted Hill-partridge (*Arborophila brunneopectus*) and the Siamese Fireback (*Lophura diardi*).

In contrast, the diets of several European species are rather well known, with the Grey Partridge among the most extensively studied. Not only has a list of food items been compiled, but how this varies through the seasons, especially during breeding, and over its range has received much attention. Introduced populations of the Ring-necked Pheasant, a native of temperate Asia, have been widely studied in many parts of Europe and North America.

Despite the great contrast in the detail available, it seems fairly safe to say that there are species which are almost exclusively vegetarian and others which feed mainly on animal matter. Chicks of most species are insectivorous, but some require greens. Confirmed vegetarians appear to be those pheasants and partridges which inhabit high latitudes or altitudes, such as the snowcocks (*Tetraogallus*) and the Snow Partridge, which are also amongst the most northerly dwelling



Although it avoids wet areas and heavy forest, the range of habitats occupied by the Chukar is quite wide, including forest clearings, hillsides up to the snow-line, slopes with bushes and trees, dry valleys, arable fields, bare stony slopes and deserts. The races which live in the most arid areas, such as this bird, are normally paler than those which inhabit damper areas, with sandier, less vinous, brown upperparts and a purer grey crown and hindneck. Differences have been observed between populations of a single subspecies, the plumage varying to resemble the colour of the local substrate.

[*Alectoris chukar sinaica*, Israel.]

Photo: Alfred Limbrunner]

members of the family. The Caucasian Snowcock, for example, eats almost exclusively plant material, consuming leaves, fruits, seeds, stems, bulbs and tubers of various plants, 65 species of which have been identified from stomach contents. Grasses and the like, such as *Poa*, *Festuca* and *Carex*, are predominant, comprising nearly 40% of the total weight of material consumed in late spring and summer and over 40% during the rest of the year. Legumes, including *Oxytropis*, *Astragalus* and *Trifolium*, make up just over 30% of the diet during these two periods, with a slightly higher proportion in winter than in summer. Some insects are reportedly eaten, but the amounts are tiny for both adults and young. Whilst the plant species taken remain broadly similar throughout the year, the parts that are consumed vary according to season, being new shoots during the spring and summer and tough parts of the plant at other times. Chicks eat similar foods, but over half of the diet is taken up with legumes, while grasses comprise well under a fifth of the total weight of plants eaten. It has been suggested that this is one way in which the young may receive protein in the absence of an insect component to the diet.

Other vegetarians include the Snow Partridge from south-west China, for which 43 plant species have been recorded from 12 individual birds, and some of the Himalayan pheasants. The Koklass Pheasant from the mid-altitude forests is believed primarily vegetarian, as is the Blood Pheasant, a resident of the upper forests and alpine areas. Indeed, the eminent pheasant naturalist W. Beebe in his monograph quoted a colleague as reporting that some birds he shot were almost inedible because of the flavour of turpentine, a consequence of a diet of recently sprouted juniper and fir shoots. The diet of the Blood Pheasant is believed to be based on opportunism, varying considerably throughout the year according to what is available and not hidden under snow and ice. It is always, however, plant material, such as fir and juniper shoots, berries, mosses and their spore cases, bamboo leaves and, not surprisingly, the reproductive parts of plants as they emerge in the spring.

At the other end of the scale are those pheasants and partridges which may be almost entirely, if not exclusively, consumers of small animals, mainly invertebrates. These are typically inhabitants of rain forests in the tropics. Information is, however, very patchy, and as more observations are made

it is becoming increasingly apparent that many of these species which were thought not to eat plants, do actually eat fruits and other parts on occasion, and are better considered opportunist feeders. Part of the reason for this misunderstanding is that the dense habitat in which they live, and the secretive nature of these tropical forest species means that it is extremely difficult to discover any details of their ecology. For example, it has been written that the Malaysian Peacock-pheasant and the Crested Wood-partridge do not consume much, if any, vegetable matter. A few observations of foraging birds and examination of droppings by G. W. Davison has shown that whilst many different invertebrates are indeed eaten by tropical forest phasianids, fruits, seeds, leaves and the like are also included in the diet.

Given that a food source such as termites may be very locally distributed on the forest floor, it could be assumed that if a bird comes across a moving column, or a termite mound, it might feed almost exclusively on termites, or ants or whatever may be locally abundant. However, the very fact that these types of food are often unpredictably distributed means that specializing on them might be risky, especially when the abundance of invertebrates seems to fluctuate so much from place to place and through time, for reasons that are not yet understood. Understorey plants that tropical forest pheasants and partridges are known to eat include those that bear berries, such as *Aglaia*, and palms (*Calamus*). Remains of corollas, rootlets and fibres, mosses and ferns have all been found in droppings. It is most striking that taken singly, each food item of these tropical forest species accounts for only a very small part of the diet, or has been seen taken only once or twice, with the exception of the odd instance when a bird has gorged itself on termites or ants. This may reinforce the belief that the birds are forced to be rather general in their choice of food. Indeed, it has been suggested that constraints imposed by diet have a major effect on reproduction in the Great Argus and Malaysian Peacock-pheasant.

Interestingly, whilst the diet of those African species which live in the interior of the forest are poorly known and plant parts are listed in among their food items, the only forest francolins for which there is any estimate of the importance of particular categories of food give conflicting information as to

The two species that form the genus *Ammoperdix*, the Sand Partridge and the See-see Partridge (*A. griseogularis*), are the phasianids best adapted to arid habitats, including even hot deserts. Unlike the *Alectoris* partridges to which they are clearly related, both *Ammoperdix* species show clear sexual dimorphism, only the male having the white patch on the ear-coverts and the longitudinal streaking on the flanks.

[*Ammoperdix heyi heyi*, Israel.

Photo: Melvin Grey/NHPA]





The Tibetan Partridge is amongst the phasianids that occur at the highest altitudes. In summer it is normally found between 3600 m and 4600 m, in areas where there is a certain amount of grass or bush cover, but it is sometimes seen in bleak areas up to at least 5600 m, very close to the snow-line, where little food or cover can be found. The white chin, the conspicuous large black mark below the eye, and the chestnut collar clearly differentiate this species from the other members of the genus *Perdix*.

[*Perdix hodgsoniae*
caraganae,
Ladakh, Kashmir, India.
Photo: Joanna Van
Gruisen/Ardea]

the prevalence of each in the diet. Arthropods, particularly *Basidentitermes* termites and *Psalidomyrmex* ants, comprise up to 90% of the diet of Latham's Francolin in the rain forests of West Africa. Other insects, including larvae, and snails are also taken and the other 10% is made up of a variety of plant material, principally fruits but also seeds and green leaves. In contrast, the Scaly Francolin, an inhabitant of equatorial rain forest, is probably primarily vegetarian, and eight birds from Zaire were found to have eaten little in the way of animal material.

Most of the African francolins from open and semi-open habitats are considered to have a mixed diet, taking both animal and vegetable matter. In some Grey-winged Francolins from Natal, South Africa, 70-75% of the volume of the crop contents was made up of bulbs and roots, particularly those belonging to the families Iridaceae, Amaryllidaceae and Cyperaceae, while 20-25% consisted of insects and other invertebrates, in summer most notably grasshoppers, ants and beetles. The remainder was made up of seeds, fruits and other plant matter.

Many of the species which inhabit these non-forested or forest edge habitats have proved capable of surviving in cultivated landscapes to some degree. In some cases, however, agricultural practices have been intensified beyond the tolerance of a species, as in the Grey Partridge of northern Europe. The cultivated lands that are most commonly inhabited are various sorts of crops, where fallen seeds are consumed along with insects living on the crop plants. Japanese Quails, for example, are omnivorous with a diet consisting mostly of seeds of weeds in cultivated areas, and also the gleanings of cereal crops. Seeds eaten include those from arable land weeds, such as chickweeds (*Stellaria*, *Cerastium*), fat-hen (*Chenopodium*) and dock (*Rumex*), as well as grain from millet (*Panicum*), wheat (*Triticum*) and oats (*Avena*). Several francolins also enter cultivation to feed, but most tend to pick up fallen grain and insects from the ground, and, like the Japanese Quail, do not damage crops.

When considering the diets of pheasants and partridges, the most striking conclusion is that the present state of knowledge is very poor. For example, whilst the diet of introduced populations of Ring-necked Pheasants is fairly well known, there is much less information from most of its natural range. As with

vocalizations, much of what is known is the result of anecdotal observations, and this has given a list of what each species will eat. When and in what proportions various foods are consumed generally remains to be investigated, and in a conservation context this means that in most instances even the basic dietary requirements are not known.

About the only conclusion that can be drawn from the information gathered so far is that whether phasianids are herbivorous, insectivorous or omnivorous depends to a large extent on their habitat. In areas where there are probably relatively few invertebrates around as potential food, such as high mountains and north temperate areas, birds eat a high proportion of plant food. Tropical rain forest, however, contains a wealth of small animal prey types, and these are of much more significance in the diet than is the case in other habitats. Although many more animal food items are consumed in such regions, there are likely very few, if any, totally insectivorous phasianids in tropical forest, which probably goes back to the fact that the supply of food is not predictable in time or space. The apparently haphazard distribution of insects in this rich and diverse habitat appears to be the result of complex and, as yet, poorly understood population dynamics.

Detailed information on the diet of phasianid chicks is even more sketchy than on that of adults. However, what is known points to the young being heavily reliant on insect food in the early stages in most cases. Most attention has been paid to the Grey Partridge in Europe, probably as a result of its importance to local economies through shooting activities. The role of diet in chick survival has exercised many partridge biologists throughout the species' natural range, and also where it has been introduced in North America. Whereas insects are believed to be only of minor importance to the adults, they are vital to the survival of chicks. Studies conducted in different parts of Europe in different seasons indicate that insects normally comprise at most 16% by volume. In contrast, up to 95% of the food items eaten by chicks in the first week of life are insects, and 80% over the first two weeks, primarily Coleoptera such as weevils, leaf beetles and knotgrass beetles, although there is much local variation. Ant pupae, insects from hay fields, aphids, plant bugs and sawfly and Lepidoptera caterpillars

The Grey Partridge lives in flocks for seven or eight months of the year.

The family group, or covey, may be joined by some unsuccessful breeders, or two family groups may gather together. In the autumn and early winter months, flock size usually averages 10-15 birds, dropping to 5-7 by the end of the winter or early spring, due to both mortality, normally higher during winter, and the departure of paired birds.

Coveys are fairly sedentary during winter, even in severe weather conditions, unless the amount of snow is such as to make grain or other food unavailable.

[*Perdix perdix*.

Photo: Richard Vaughan/
Ardea]



are all important at some stage in various areas. Some insect groups are avoided, such as thrips, carabid beetles, swift-fly-flies and parasitic wasps.

There are a few striking exceptions regarding the chicks' requirement of insects in order to grow healthily. Snowcocks from the upper slopes of high mountains in Europe and Asia are almost exclusively vegetarian, and this appears to be true of chicks as well, although, as noted above, they take far higher proportions of leguminous plants and far fewer grasses.

Information on seasonal variation in diet is restricted to a few species. The Grey Partridge consumes more insects during the summer months than in winter, when they comprise a negligible part of the diet. It seems likely that, once again, the kind of food taken will reflect what is most readily available at a particular time, in most cases. In south-east Asian forests, the presence of some food sources is not predictable. For example, some tree species do not flower and fruit on an annual cycle, and figs (*Ficus*) are markedly aseasonal in their flowering patterns. This seems to mean that particular items among both these potential food types and also the invertebrates that feed on them are available to the local pheasants and partridges on an irregular basis.

Most phasianids feed on the ground, although some may climb into bushes or even onto low branches of trees. The Satyr Tragopan, for example, takes leaves, moss and berries from species such as *Berberis*, *Symplocus* and *Rhododendron*. The other tragopans and the Blood Pheasant are also arboreal to some extent. In the main, however, foraging is done at ground level, and ranges from snapping at insects to gleaning seeds and turning over leaf litter, to digging over the ground to reach roots and tubers.

The bills of some of the pheasants, in particular, have attracted comment on their suitability for excavating large areas of soil in search of food. The strong bills of the monals, the Cheer Pheasant and the eared-pheasants, for example, are all ideal for digging up various foods found below the soil surface during part of the year at least. These species characteristically feed on tubers, roots, bulbs and subsoil invertebrates, and large areas of dug-over soil are typical signs of their presence. The Cheer Pheasant tends to feed on these subterranean foods in the winter when other items are unavailable.

As well as digging, Cheer Pheasants have been observed pecking at vegetation near the ground and browsing on shrubs and tall grasses and other plants that appear seasonally. The most intensive study of the species conducted to date showed that browsing was the least common of these methods. Females spend more time feeding than do males, spending about 70% of their time looking for food, compared with the figure of just over 40% that males devote to foraging. Whilst both sexes spend more time digging and picking up items from the exposed soil than they do pecking at vegetation, this difference is far greater for the females, which may spend the vast majority of their time digging.

Tropical forest species generally appear to have less stout bills and to feed by turning over leaf litter, either with the bill alone, or using their feet to scratch away as well. Birds then peck at the exposed soil surface, picking up various foods, including invertebrates such as *Campanotus* ants. In Malaysia, it has been suggested that the foraging technique that a species uses ties together its dispersion with that of its invertebrate prey. For example, the Crested Wood-partridge, and the Crested and Crestless Firebacks, all species that often form groups, tend to scratch at the leaf litter so that they can take the invertebrates that live underneath this layer. These invertebrates are often small colonial species, and when one of the birds finds food, the other members of the flock come to feed beside it on the abundant supply; clusters of fallen fruit also attract such flocks. Solitary species, such as the Great Argus, do not tend to use their feet much, simply picking up items from the surface of the litter, rather than from underneath it. Their invertebrate prey seems to be confined to single larger animals, such as large ants and bugs, which are walking alone.

Obviously, foraging is an important part of the daily routine of the phasianids (see General Habits). Outside forested habitats, it most typically occurs in the early morning or late afternoon. This is often because of the midday heat of the tropics and subtropics, but the presence of potential predators has been suggested as a major determinant of Chinese Monal's feeding times during winter: on fine days up to ten birds of prey have been recorded circling overhead in the middle of the day.

Breeding

There is a considerable diversity of breeding patterns exhibited by the phasianids, including monogamy, and both simultaneous and sequential polygyny. Whilst D. Lack reported that just over 90% of all bird species are monogamous, there is a disproportionate number of non-monogamous species among the Galliformes. Indeed, nearly one third of the genera in the Tetraonidae, Meleagrididae, Odontophoridae, Phasianidae and Numididae are believed to be typically polygynous or promiscuous, a much greater number than among birds in general.

As phasianids produce nidifugous chicks, which can move about very soon after hatching and feed themselves, the parents do not have to find food and bring it back to nestlings, as is the case in most other bird families. Therefore, parental responsibilities are confined to brooding the chicks, guiding them towards food sources, and watching for predators. These are all activities that one adult can perform adequately, and the presence of a second adult rarely doubles the effectiveness with which these duties are carried out. This means that, in some cases, the presence of males may not prove especially beneficial to chick survival, and, as a consequence, the family group consists of only the adult female and the chicks. The result is a shorter pair-bond between male and female, which allows males to try and attract other females for mating. In this situation, many males might be competing for mating opportunities with relatively few females, resulting in fairly intense selection pressure being exerted on any heritable male trait that will improve a male's chances of attracting a mate. Such traits might be morphological or behavioural, and might include more extravagant plumages or better fighting ability.

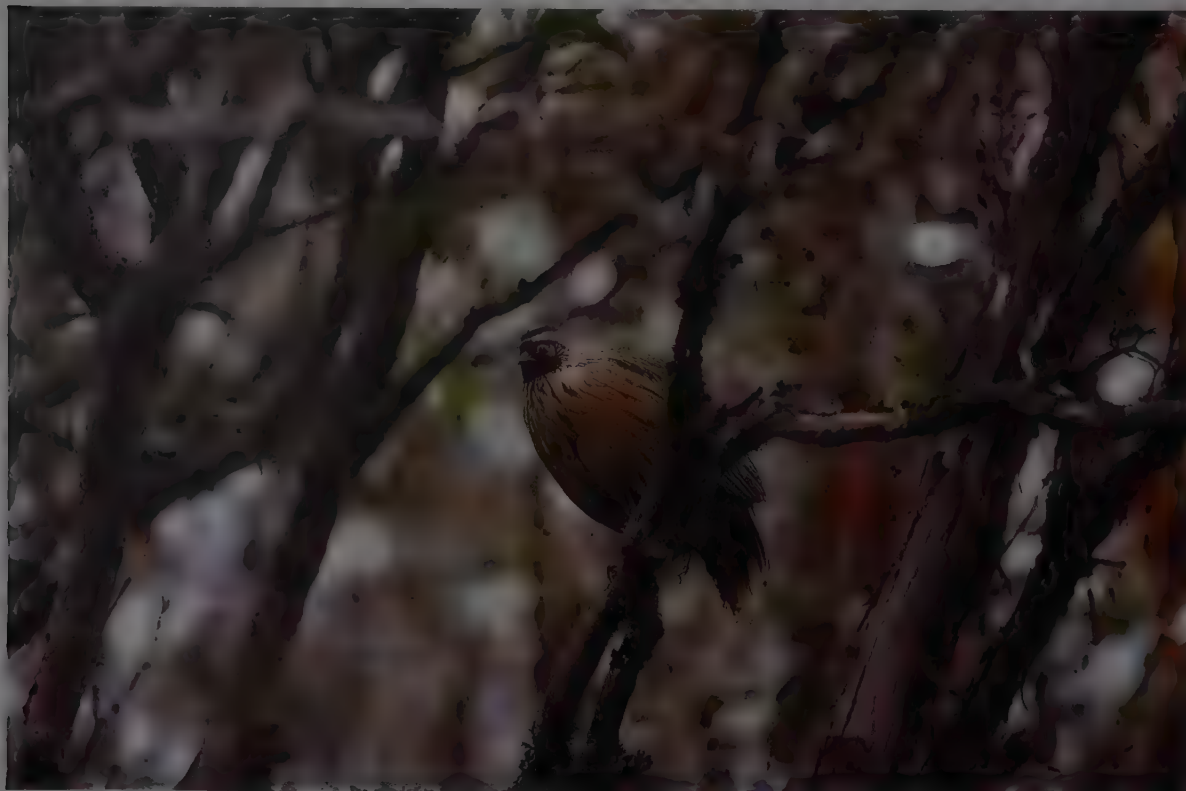
In the early 1980's M. Ridley reviewed what was known about mating systems in the pheasants, partridges, quails, snowcocks and francolins, and also in some other Galliformes. Although some new information has been added, many of the generalizations remain pertinent. In monogamous species, the pair-bond usually lasts at least for one whole breeding season, and both parents help to raise the young. In some instances, the male may also share incubation duties with the female. Amongst those perdicines for which there is any information available, monogamy is found in virtually all genera, whereas

about half of the pheasant genera are probably non-monogamous.

Most of the African francolins are believed to be monogamous, as they have been seen in pairs during the breeding season, and the only exceptions, for instance the Grey-striped Francolin (*Francolinus griseostriatus*) and Handsome Francolin, are too poorly known to admit even suppositions as to what their mating systems might be. In monogamous francolin species, the pair-bond may last more than a single season. The duties of the sexes have been studied in several species, usually those from open habitats, where observation of birds is considerably easier than in forests.

The Rock Partridge of southern Europe, along with other *Alectoris* species, is monogamous, but instances of successive bigamy have been reported. Pairs form from February onwards, as winter flocks begin to break up into smaller groups. From March and April, pairs establish territories, often using the rally call, the function of which varies according to season; it is mainly used for territorial assertion during spring. Females are believed to lay only when all boundary disputes have been settled. Whilst males are believed not to assist the female in the incubation of the eggs, some males have been found with brood patches. The male usually, however, attempts to maintain the integrity of the territory during incubation. The size of the males' territories appears to bear some relation to the structure of the winter flock, whereby the most dominant males obtain the largest areas, but availability of cover and food and the density of the population all influence this association. If, however, a second clutch is laid, the male incubates this alone, which may account for the presence of brood patches in some individuals. When the chicks hatch, the females raise the brood on their own, the males forming small, single-sex groups.

Non-monogamous mating patterns observed in the Phasianidae include both simultaneous and sequential polygamy. In the former, each male pairs with more than one female at the same time, whereas in the latter, a male pairs with one female after another. Simultaneous polygamy is also known as harem polygamy and is seen in several species, such as the Red Junglefowl and Lady Amherst's Pheasant, while the Ring-necked Pheasant is the best known example, by virtue of the study of its introduced populations.



The Blood Pheasant is a species associated with the margins of conifer or rhododendron forest, roosting in the interior and coming out into the open to feed. One of the few occasions on which the species flies is to reach its roost, as it generally prefers to escape from danger by running. This is the smallest of the pheasants and its rather short tail and overall appearance suggest a colourful francolin. Unlike most francolins, however, this species is highly sexually dimorphic in plumage, the female being mainly brown. The Blood Pheasant is generally considered to represent some sort of a link between the partridges and the pheasants.

[*Ithaginis cruentus*
cruentus, Sagarmatha
National Park, Nepal.
Photo: Joanna Van
Gruisen/Ardea]

The Indian Peafowl climbs trees during the day to rest or to hide from danger, and it will also do so at night in order to roost. Birds often choose the top branch of a dead tree, apparently impervious to bad weather, even on nights of heavy rain. The huge train, which can make up 160 cm of the bird's total length of about 230 cm, makes this species one of the largest birds capable of flight. Contrary to appearances, the highly ornate and surprisingly light-weight train is not formed by the rectrices, which are dull coloured and of moderate size, but by the 100-150 uppertail-coverts, each of which has long, disintegrated barbs and a large subterminal ocellus.

[*Pavo cristatus*,
Sri Lanka.

Photo: Alfred Limbrunner]



The Ring-necked Pheasant tends to be found in single-sex flocks during the winter, though this depends to some extent on the availability of suitable habitat. The two sexes appear to use different habitats during the winter, the females inhabiting woodland with a shrub understorey, and males using scrubby areas such as hedges and woodland edges. Females disperse from their winter flocks during late March and early April, when average flock size falls from six to two birds. Large overlapping winter ranges within woodland are replaced by widely separated breeding ranges in more open habitats. Males also move out into more open areas, taking up territories which encompass the edges of woodland. During dispersal, females, usually from the same winter flock, continually join and leave harems. The number of females to be found with each territorial male can vary considerably, some males obtaining many females, with up to 18 reported, whereas others may attract very few, if any. Nest-site selection, incubation and the raising of the young are all carried out by the female alone, while the male continues to defend his territory and display to females that are not sitting on eggs. Once all the females in a harem have nested, the male may cease the defence of his territory and eventually abandon it.

Conclusive evidence that sequential polygamy is the main reproductive strategy for any phasianid is lacking, but it is believed that the male Satyr Tragopan remains with the female only until the onset of egg-laying, or very early incubation at the earliest. The system is, however, known to occur occasionally in several species, such as the African Blue Quail (*Coturnix adansonii*). In this species, in places where the sex ratio may favour successive polygamy, the female incubates the eggs and tends the chicks on her own, whilst the male is presumably left free to mate anew.

Promiscuous pheasants appear to have one of two mating patterns, which are described in terms of the dispersion of males: promiscuity with aggregated males; and promiscuity with dispersed males. The only pheasants in which the males gather together in groups to display to females are the two Asian peafowl. Whilst the display dispersion of male Green Peafowl is poorly known, the Indian Peafowl, a common sight throughout much of south Asia and in many parks and gardens

elsewhere in the world, has been the subject of a fair amount of study, in both India and the UK. The dispersion of the males does appear variable according to local conditions, but in general they tend to be clumped together. Harem polygyny has also been reported for both of these species.

The clumping of peacocks to display to females falls within the dispersion pattern that has been described as a lek, a collection of males that are drawn together simply for the purpose of attracting females with which to copulate. In India, breeding seasonality varies according to the onset of the wet season. Each male establishes a territory in close proximity to other males. These territories are defended by threatening or attacking intruding males, and visiting females are displayed to. Females seem to wander through the various territories on the lek, sometimes singly and sometimes in groups, and they may move between the different clusters of males. A study of the feral population resident at Whipsnade in southern England revealed that females may visit several different males in a lek, and revisit a preferred male, possibly many times, before finally copulating with him. Of eleven occasions when a female's path through the lek was monitored in detail, she mated with the male that had the most eye-spots on his train ten times. After copulation, the females nest, incubate and rear the young without the assistance of a male.

Promiscuous species in which the males are dispersed rather than clumped together during the breeding season include the Malaysian Peacock-pheasant, the Great Argus and the Crested Argus, all inhabitants of rain forests of south-east Asia. Males of all three of these species make display scrapes, which are also referred to as "dancing grounds"; they clear leaf litter from a small area of the forest floor, so that the bare earth below is exposed. Studying these secretive rain forest species is not easy, but the spacing patterns of males has been documented in some detail.

On Gunung Rabong, a mountain in Peninsular Malaysia, Crested Argus males were heard calling within a narrow altitude band at 600-900 metres above sea-level. The calling males appeared to be a minimum of a half a kilometre apart, but, whilst their calls do carry that distance, birds are not in visual contact when on their display areas. In the closely related Great



Although the Grey Partridge's main habitat requirement is the presence of areas of continuous grass or herbage, it also requires access to areas of bare ground where the bird can dust-bathe. The bird first lies down on the ground, then scratches up dust or sand into the plumage with its feet, and throws it up onto its back with its wings, before finally shaking it out. Such behaviour helps to keep the plumage in good condition, mainly by removing excess preen oil, dry skin, feather debris, and the like.

[*Perdix perdix*.
Photo: Robert Maier/
Aquila]

Argus, only adult males are believed to maintain such cleared areas in most years. Females were seen visiting males on their display sites, which are typically widely spaced on small hills in the lowlands, and it has been suggested that females roam through the forest visiting various males that are in possession of display sites. The male's display is quite extravagant, to the human eye at least. Following copulation, as in the Indian Peafowl, the female is responsible for the incubation and all the parental care, while males continue to call and maintain their display sites.

Why is there such a diversity of reproductive patterns among the pheasants? Two of the suggestions put forward are closely related to habitat: food availability; and habitat structure. In the first, it is thought that competition for patchily distributed items of animal prey in tropical forest has resulted in largely insectivorous tropical forest species adopting a solitary lifestyle. In contrast, open country species tend to feed on widely distributed foods, such as grains and other seeds, together with invertebrate prey that is similarly widespread. The second proposal, that related to habitat structure, centres on the need for mate guarding. In open country habitats there is little concealing vegetation, and females can be observed relatively easily by both predators and conspecific males, which leaves them open to attack by the former and harassment by the latter. Therefore, long pair-bonds have resulted, whereby a

male guards the female from unwanted attention. Where females remain gregarious throughout the breeding season harem polygyny has evolved because a single male is able to guard more than one female at a time. In the denser, closed habitats, females are more effectively concealed by the dense vegetation, and, as a consequence, are not bothered so much by predators and conspecific males. There is, therefore, less need for mate guarding by the males, and this has led to shorter-lived pair-bonds, such that in the extreme the pair-bond lasts for the duration of copulation only. The final stage in this proposal is the movement of promiscuous species from the forest back to open or semi-open habitats with an attendant shift from solitary to gregarious breeding habits.

The degree of sexual dimorphism that is so variable throughout the family (see Morphological Aspects) appears to be associated with the mating pattern in a given species. H. Sigurjónsdóttir reviewed the degree of sexual size dimorphism in relation to colour dimorphism and the extent of parental care in 89 species of Galliformes for which data of varying quality could be obtained. This revealed that the sexes were alike in monogamous species in which the male assists in the care of young, whereas the sexes differed, sometimes strikingly so, in polygynous and promiscuous species in which the males plays no part in rearing the offspring. Sigurjónsdóttir concluded that sexual dimorphism among the Galliformes, which are herbi-

vorous and omnivorous and have precocial young, is the result of sexual selection. Increased dimorphism in both size and colour, as well as the development of other special characteristics, in both polygynous and promiscuous species, is believed to be the result of increased selection pressure on the males to gain mating access to the females. A male that does not form a long-term pair-bond with a female has the opportunity to mate with more than one female, and therefore competition between males for mating opportunities is, potentially, fierce.

Pheasants have long been thought of as examples of sexual selection, but with no firm evidence to support this, until recently. The aforementioned Whipsnade study of the Indian Peafowl shows that the more extravagant a male's train, the better his mating success. A separate study indicates that the train increases in splendour as the male ages, implying that females are able to choose to mate with older males, which have demonstrated their ability to survive. Of course, alternative explanations for these observed patterns of behaviour abound.

In most species the timing of breeding is believed to be governed by the seasons, be they the four seasons of the north temperate regions, or the wet and dry seasons of the tropics. Throughout the Palearctic and along the Himalayas, the beginning of spring sees the commencement of breeding activity. The exact timing depends upon the latitude and also the altitude of the locality. For example, southerly *Alectoris* partridge populations begin laying between late March and late April, whereas egg-laying in the snowcocks, which are inhabitants of upper mountain slopes, begins in late April at the earliest.

In these relatively high latitude species, winter dispersion patterns break up prior to egg-laying, as courtship commences and nest-sites are chosen. In the Altai Snowcock (*Tetrao gallus altaicus*) winter coveys of up to 35 individuals split up during March, when pairs form and leave the group. Older birds are believed to begin nesting earlier than younger ones. Both sexes become aggressive, and fights between pairs are common. Nests are made on south-facing slopes and are built by females.

Such direct information on the timing of breeding is lacking for most Himalayan species because of the difficulty in seeing

birds, let alone watching their courtship and finding their nests. There is some information on the duration of the calling season in some species, however. Four pheasants from north-west India are most readily detected by their vocalizations, namely the Koklass and Cheer Pheasants, the Himalayan Monal (*Lophophorus impejanus*) and the Western Tragopan (*Tragopan melanocephalus*). The first three are all calling by the end of January or the beginning of February, whereas the Western Tragopan does not appear to call at dawn until late March or early April. All four call until the beginning of June, and the Cheer and Koklass also chorus at dawn in the autumn and winter months. The role that calling by the male plays in the breeding cycle is likely to vary according to the species. For example, it may be that Koklass Pheasants need to call through much of the year in order to maintain territories, while Western Tragopans only set up territories in the spring and call to establish themselves and attract mates.

Further west, the species inhabiting the arid zone of the Middle East also breed, in the main, in the northern temperate spring and summer. Thus the Sand Partridge (*Ammoperdix heyi*) and the Arabian Partridge (*Alectoris melanocephala*) begin laying sometime during March or April in Oman and Jordan, depending on locality and species.

The widespread African francolins breed in various months in the different parts of their ranges, usually coinciding with local wet seasons, although Shelley's Francolin (*Francolinus shelleyi*) breeds during the dry season, whenever that may be at any given locality within its patchy distribution. The widespread Red-necked Francolin (*Francolinus afer*), for example, breeds in the late wet or early dry season, ensuring that there is a flush of vegetation following the rains. This means that somewhere in its range it is breeding at any given time, be it from March to June in Angola, January to August in Malawi, or in all months except August to October in Zimbabwe, to consider just three range countries.

The seasonality of tropical rain forest phasianids in south-east Asia is the most poorly known in the family. The little information that exists points to regional patterns that are very different from those elsewhere. Two separate studies, of the Malaysian Peacock-pheasant and the Great Argus, have suggested that individuals are unlikely to breed every year. Based

The crow of the adult male Red Junglefowl is surely the best known of all bird calls. Its function is often territorial, the bird crowing from the roosting site before dawn, and also during the day whilst it patrols territorial boundaries or if other males encroach. Other functions of crowing include: a prelude to mating; a proclamation of dominance over subordinate birds; gathering the flock together after feeding, when the birds are ready to move on; and, after checking that there is no danger, informing the flock that it can safely cross open ground.

[*Gallus gallus*,
Philippines.
Photo: Günter Ziesler]





The advertising call of the Coqui Francolin is made up of a series of 7-10 trumpet-like notes, the earlier ones being the loudest, and the later ones weakening. This call is normally made in the early morning, at midday and in the late afternoon, although at the onset of the breeding season it is generally heard much more often. This species' other characteristic call, which is uttered throughout the day, is a repeated series of two high-pitched, squeaky notes, "cô-qui, cô-qui, cô-qui", which have given the bird both its scientific name and its common name in several languages. This calling bird clearly shows the feature which best distinguishes the male of this species in the field, namely the rather uniformly ochre coloured head and upper neck, sharply separated from the barred lower neck and upper breast.

[*Francolinus coqui hubbardi*, Kenya.
Photo: Jonathan Scott/
Planet Earth]

Whilst the Brown Quail can satisfy its water requirements from insects and other invertebrates with which it supplements its basic diet of grasses and other small herbs, it can sometimes be seen drinking at water-holes and streams. It shows a certain preference for swampy habitats, and frequently inhabits fringes of freshwater wetlands, floodplains, salt-marshes along seashores and backwaters of artificial wetland habitats. The three birds with coarser black markings on the upperparts are females.

[*Coturnix ypsilophora australis*, Australia.

Photo: G. D. Anderson/
ANT/NHPA]



on circumstantial evidence, it was concluded that food availability is the major constraint on reproductive efforts in these two species. The availability of food for these birds does not appear to be under the regulation of an annual cycle, but it might be strongly influenced by mast-fruiting years. In these years, which may occur from five to ten years apart, many tree species flower and fruit simultaneously, and invertebrate populations increase as a result. Consequently, there is much food that is potentially accessible to the pheasants. Numbers of calling male Malaysian Peacock-pheasants were much higher in one such year, as were the number of maintained display scrapes. If this proposal is correct, then breeding periodicity is not seasonal in these species, but may span several years, and may vary from one individual to another, depending upon the ability of each to secure food resources.

Whatever the breeding periodicity, the beginning of the reproductive period is marked by courtship, which may involve both visual and vocal displays. In many cases, it is not known how males and females come together. Calls by males, assumed to be advertisement calls, are reported during part of the year for many species. In some cases, such as that of the Grey Partridge, if both members of a pair survive till the next season they will reunite while still in the winter covey. It is more common in this species, however, for birds from different groups to pair up in advance of nesting, possibly up to four months beforehand.

Males of many species advertise their presence by calling. The dawn crowing of Red Junglefowl, or domestic cockerels, amongst other species, is well known throughout the world. Variation in vocal behaviour between individuals in phasianid populations has received scant attention. One study has, however, shown that there may be considerable difference between individual male Malaysian Peacock-pheasants in both the rate at which they call and also the type of loud call that they give, and similar variation among males of the Great Argus has also been reported. In dense rain forest, vocal signals may well be the easiest method by which birds can locate conspecifics, and vocal displays may therefore be of considerable importance. Not all species, however, call loudly at the onset of the breeding season, and several tropical forest pheasants and partridges are quiet for much of the time. The Crestless Fireback, for example, has no known loud crow.

The visual displays of some of the pheasants are very striking and have received much attention in popular books and articles. As with vocal displays, however, there have been few attempts to investigate these behaviour patterns in detail. Many

of the various display postures have, however, been described, and the full-display repertoires of many species are known, often from observations of captive birds.

Many of the phasianid displays have typically been categorized as frontal or lateral, descriptions which refer to the orientation of the male to the female whilst either posturing or moving. Lateral displays often involve the spreading of wings and tail in such a way that the bird appears larger when viewed from the side. For example, the wing nearer the female may be dropped so that the primaries are close to the ground, while the wing further away is raised, as in the Palawan Peacock-pheasant. The tail may also be spread in the vertical plane, whether it is compressed, as in Bulwer's Pheasant, or not, as in the Malaysian Peacock-pheasant.

In frontal displays the male faces the female, and when spreading the wings or tail, tends to do so symmetrically. Male Silver Pheasants and Temminck's Tragopans (*Tragopan temminckii*), for example, face their respective females and rear up when opening the wings, which they beat either rapidly, as in the "wing-whirring" element of the former's display, or slowly, as the latter does when wing flapping.

As well as the lateral or frontal orientation of the wings and tails and movements, many of the display elements also involve inflating, raising or exposing various parts of the body, such as wattles, ruffs or lappets so that they are shown to the female to the maximum extent and effect. Hence lappets, which unfold under the throat, are shown during frontal display in the tragopans, and wattles, which expand above and below the side of the head, for example in Bulwer's Pheasant, are mostly inflated during lateral display.

Whilst many of the display elements can be grouped into one or other of the two directional categories, males of some species exhibit both lateral and frontal display at one time or another. Male Grey Peacock-pheasants (*Polyplectron bicalcaratum*), for example, may either face the female or stand side on to her. In the frontal display, the male lowers the head and breast towards the ground, and raises and spreads the tail, so that it appears relatively vertical. The head is usually slanted to one side. In the lateral display, the nearside wing is lowered slightly, the farther one raised, and the tail spread. Both postures present the female with an array of ocelli borne on wing and tail feathers, but one is orientated more vertically than the other. As far as is known, the most elaborate displays appear in the polygynous and promiscuous pheasants, whilst the displays of monogamous species contain fewer separate movements.



Although the Ceylon Junglefowl spends most of its life in forests or dense scrub, it often ventures out to feed in open fringe areas, such as roadsides or glades. This seems to be commoner after heavy rain, and it has been suggested that it is in order to avoid feeding under dripping trees. The species feeds mainly by pecking at the ground, taking grain, weed seeds, berries and other plant matter, as well as numerous insects and invertebrates. This species can most easily be distinguished from other junglefowl-species by its streaked body plumage and the large yellow patch in the middle of its comb.

[*Gallus lafayetii*,
Wilpattu National Park,
Sri Lanka.
Photo: Dieter & Mary
Plage/Survival]

In the monogamous Swainson's Francolin, for example, males stand upright and, pointing the bill upwards, give the advertising call. The bare red throat skin, which appears to be more richly coloured during breeding, is somewhat inflated. Females reply by standing upright as well, giving a different call that is said to resemble the cry of a human baby. After a couple of minutes of calling, the male chases the female, displaying laterally, rather half-heartedly, and if the female remains, he then displays much more intensely. In this last phase, the head is held upright, the bill pointed forward and the wings fanned so that they are nearly dragging on the ground.

This contrasts notably with the case of the Great Argus, in which the male has ocelli-bearing secondaries that are up to a metre in length and a tail up to nearly 1.5 m long. In this species, males call from widely spaced dancing grounds in the forest. In a sequence watched in the wild, a male descended from a perch adjacent to the dancing ground from where he had been calling, upon the approach of a female. Normally, at the beginning of display in this species, all the feathers of the male's head, neck and body are ruffled, and the male moves onto the dancing ground, walking around the edge with his head held forward and low, and his neck arched. At each step, the male stamps his foot onto the ground, as he circles the female which stands on the dancing ground. The male then continues to walk around the edge of the dancing ground with his tail held increasingly higher to the extent that his body becomes nearly vertical. The male may, sometimes, break into a run around the female in which a cowering posture is adopted, whilst the male trots in arcs with short, rapid steps. Lateral display follows the "Tail-high Walk", and the upper surface of the male's body is tilted towards the female, whilst he runs back and forth. After such a lateral movement, the male swerves to face the female and lowers the head and breast, whilst raising the tail. The wings are spread fully and reflexed at the carpal joints to allow the outer primaries to overlap, giving the appearance of a fan of wing feathers. During the full period of display, the male may switch back and forwards between postures and movements, or occasionally turn with a jump and a wing flap, and run across the dancing ground. "Tidbitting" of various sorts is interspersed between these elements, and its

exact nature varies according to the stage of the display in which it is exhibited. It may simply comprise pecking at the ground, or involve picking up objects and offering them to the female.

"Tidbitting" is a type of ritualized courtship feeding that most male phasianids are believed to exhibit. It typically involves a male either pecking at some food or food-like item, or holding it in the bill and giving a distinctive call at the same time. This often causes a female that is close by to move towards the tidbitting male.

Once courtship is completed and the male has copulated with the female, the search for the nest-site begins, either by the pair together or by the female alone, according to the species. At least one nest has been found of most species, but several are still undescribed, including those of the Grey-striped Francolin of Angola, the Black Wood-partridge (*Melanoperdix nigra*) of Malaysia, Sumatra and Borneo, and Blyth's Tragopan of the Eastern Himalayas. One or two nests are all that have been found in many other species, so generalizations about the nesting behaviour of particular phasianids are not possible in most cases.

Some very broad conclusions can be drawn, however. For example, all known nest-sites are on the ground, with the exceptions of the tragopans which nest on stumps or in trees or bushes up to ten metres above the ground, and the single reported nest of Nahan's Francolin which was placed in the hollow of a tree about a metre off the ground. An interesting case is that of the Swamp Francolin, which inhabits the tall, wet grassland of the *terai* belt along the Indo-Nepal border and north-east India. As it dwells in grass around swamps and standing water it constructs a nest of weeds and wet grass which may be up to 10 cm thick and 30 cm in diameter, with a depression in which the eggs are laid. This structure is built just above the water or mud among fallen and bent reeds, or in other suitable sites in the vegetation of this wet area.

In open country, such as savanna, open bushland and boulder-strewn plains, most nests are found at the bases of tufts of grass or bushes, or next to rocks or boulders. Such nests are typically a simple scrape in the ground, which may, as in the White-throated Francolin (*Francolinus albogularis*) and Hodgson's Partridge, or may not, for example in the Yellow-necked

Francolin (*Francolinus leucoscepus*), be lined with a mixture of dried grass stems, leaves and roots. In a number of cases the amount of lining employed varies from unlined to fully lined within a single species, presumably depending on local conditions and the tendencies of individual birds.

Forest-dwelling pheasants and partridges also seem to prefer a site at the base of some prominent vegetation feature or other. In the equatorial forest belt of West Africa and the lowland forest of south-east Asia respectively, Latham's Francolin and the Crestless Fireback tend to lay their eggs between buttress roots of trees. Whilst the francolin simply lays them on the forest floor without constructing any real nest, the fireback may gather some twigs or similar material together on which to lay. As with open country phasianids, however, the construction of nests can be rather variable within a species. For example, the four known nests of the Malaysian Peacock-pheasant were found: in a shallow depression on top of a termite mound 1.4 m high; directly on the ground among understorey vegetation; in sheltered vegetation against a recent windthrow; and at the base of an understorey tree.

Cabot's Tragopan is the best known of the tree nesting tragopans. Out of 15 nests known, 13 were found in trees within 20 metres of the edge of forest, 10 built in *Pinus taiwannensis* and five in broad-leaved trees.

Once a nest-site has been chosen, the eggs are laid. Clutch size varies considerably through the family, in several cases reaching 18 eggs or more, for instance in the Chukar and the Rock Partridge, the Black Francolin (*Francolinus francolinus*), the Brown Eared-pheasant (*Crossoptilon mantchuricum*) and the Ring-necked Pheasant, although these appear to represent unusual situations, and it is suspected that more than one female may have contributed to the clutch in some cases; the norms for these species are in the region of 7-12 or up to 15. Nonetheless, female Grey Partridges are known to produce even larger clutches, and it has been confirmed that in some instances well over 20 eggs may be laid by a single female. In this species, clutch size increases from south to north and from south-west to north-east.

At the other extreme are the tropical forest species of south-east Asia. Those species for which clutch size is actually recorded lay fewer eggs, and the Malaysian Peacock-pheasant is at present the only phasianid that is known to lay a single egg clutch. The tropical forest gallo-pheasants (*Lophura*) also lay smaller clutches than their more northerly relatives. The Crestless Fireback, for example, lays 4-5 eggs, whereas the congeneric Silver Pheasant on average lays 7 eggs, but up to 12 in south-western China, and the western Himalayan subspecies of the Kalij Pheasant lays 6-9 or even up to 15 eggs.

The suggestion that food supply may well be limiting in tropical forest may also apply to clutch size. Whereas in seasonal regions the appearance of phasianid chicks tends to coincide with annual peaks in food supply, such peaks can not be predicted on a similar time scale in tropical forest. Therefore, the larger clutches of the seasonal climates seem likely to be a consequence of reliable food sources being available on a predictable basis.

Egg size too varies quite considerably, as might be expected from the range of body sizes in adult phasianids. A rough analysis of the ratio of individual egg weights to adult female weights among the pheasants only revealed that eggs weighed from 2.5% to 10% of the adult female's weight. Similarly, the whole clutch comprised upwards of 15% of the female's weight, with the Cheer Pheasant laying a clutch that is alleged to amount to a staggering 63% of the female's weight.

Incubation is usually carried out by the female only. In monogamous pairings, males are concerned with territorial defence during this time, and in non-monogamous pairings, males may attempt to attract other females with which to mate. The shortest incubation periods have been reported as 14 days in the Harlequin Quail (*Coturnix delegorguei*) and 16-18 days for its congeners. In the Indian Peafowl, by contrast, it takes 28-30 days for the eggs to hatch. In most phasianids, incubation takes 18-25 days. When the eggs hatch, synchronously, the eggshells are usually left in the nest.

On hatching, the precocial young are capable of feeding and moving about straight away. The young are led to food

The Indian Peafowl almost invariably goes to a stream or a water-hole to drink after its main feeding periods, early in the morning and about an hour before sunset. After its morning drink, it normally leaves the open plains and scrubland where it finds its food and goes into forest where it will spend the hottest hours in the middle of the day, busying itself much of the time with the tasks of preening and dust-bathing.

[*Pavo cristatus*,
Sariska Tiger Reserve,
Rajasthan, India.
Photo: Gerald Cubitt/
Bruce Coleman]





The Himalayan Monal lives mainly in forests, but it moves to open areas, such as grassy ridges, meadows and mountain cultivation to feed. Its powerful, strongly decurved bill is designed for digging. It will often spend a fairly long period digging in one place (like two of these three females), when it may dig down to depths of 25 cm or more, to reach the bulbs, rhizomes and tubers that make up much of its diet. This species is commonly found in small groups of three or four birds of the same sex, or of one male with two or three females, although single birds are also seen at times.

[*Lophophorus impejanus*, Sagarmatha National Park, Nepal.
Photo: Joanna Van Gruisen/Ardea]

sources by the parent or parents, and they then peck at food items on their own. Food may be picked up and tossed towards a chick, placed in front of it or even passed from bill to bill. Food calls may be particularly in evidence at this time as adults alert the young to the presence of food items. Chick mortality is very poorly understood, and relevant data are lacking for most phasianids. This aspect has, however, attracted considerable attention in the Grey Partridge.

In this species chick mortality is highest during the first ten days of life, and much of this mortality has been ascribed to lack of sufficient insect food in the intensively farmed regions in which the birds live. Introduced populations of Ring-necked Pheasants also experience high levels of chick mortality, which, it is suggested, may be due to sudden changes in weather causing birds to become wet and cold.

Flight has been reported at only five days old in the Harlequin Quail, and 10-14 days old in the Barbary Partridge (*Alectoris barbara*) and the Red-necked and Yellow-necked Francolins, among others, and this is believed to be fairly typical, although there is little reliable information available for most species. Whilst very young, the chicks may be brooded by their parents.

In the vast majority of species, the behavioural development of the young in the wild is either very poorly known or not known at all. In many open country species, coveys, including young, may be seen for several months and even, in a few instances, right up to the start of the following breeding season. Some family parties join together to form larger coveys, as in the Barbary Partridge during the autumn. One of the functions of coveys is to improve defence. Distraction displays are described for a number of species, including the Harlequin Quail, and are probably fairly widespread throughout the family. One of the adults feigns injury whilst leading a potential predator away from the chicks which hide and remain motionless. Chicks of many species are of adult size by about two months old.

The behavioural development of young chicks has been studied in a feral population of the Burmese subspecies *spadicus* of the Red Junglefowl. Methods of locomotion and feeding are among the earliest behaviour patterns to appear. Chicks are capable of walking, running, jumping and hopping

by the third day at the latest, and hopping soon develops into flight, which does not occur until day 12 in this species. The repertoire of feeding techniques is also rapidly built up, beginning with young birds pecking at objects that contrast with the background. Running with food items occurs from day 2, and scratching the ground begins the following day. Running with food items is possibly a means of attracting other chicks, and the resultant increased attention may ensure that the prey does not escape; it might also develop eventually into tidbitting behaviour. Other feeding-related behaviour patterns include bill-wiping and head-shaking, and these are present by the end of the first week. Various comfort, preening, aggressive and dust-bathing activities all become evident over the following one or two weeks.

When they hatch, the chicks are largely clothed in down, although some feathers of the juvenile plumage may already be present at this stage, such as the first seven primaries. The other primaries appear during the following three or four weeks. The first moult, the post-juvenile, begins shortly after hatching, at about 23 days old in the Ring-necked Pheasant. In this species, it takes 150 days for the primaries and secondaries of the first winter plumage to complete their growth, and 170 days for the completion of all the coverts, whilst the tail feathers grow more quickly.

In those species in which males possess spurs, the timing of the irruption of the spur from the rear face of the tarsus is very poorly known. In the Yellow-necked Francolin, the spurs are apparent at about four and a half months old, and in the Red-billed Francolin (*Francolinus adspersus*) they can be seen from about five months old. It may take up to a year before they become fully grown and sharp.

Most species become sexually mature within the first year, although the adoption of full adult plumage, in males at least, takes longer in a few cases. For example, the train of the male Indian Peafowl takes four years to develop fully, while the male Silver Pheasant assumes adult plumage within two years. Nevertheless, a male Malaysian Peacock-pheasant in captivity has been known to father offspring whilst still in subadult plumage.

Breeding success is yet another aspect that has been relatively well studied in only a few species, and about which

The Grey Peacock-pheasant normally forages slowly and secretively. Even when turning over leaf litter with its bill or scratching the ground with its feet to uncover food, it does it silently. Once the food item is visible, it is carefully picked up with the bill. This species is essentially omnivorous, with food recorded including insects, fruits, shoots, leaves and grubs of many types, as well as rice and grain from village cultivation.

[*Polyplectron bicalcaratum*.
Photo: N. Dennis/NHPA]



virtually nothing is known for the majority. In the Red-legged Partridge (*Alectoris rufa*), a significant factor can be the weather, but it has been found to have different, even opposing, effects in different regions. For instance, in eastern England, rain in June and July can lead to lower overall productivity, as a result of the combination of lower temperatures, increased energy and feeding requirements and lengthier exposure to predators. However, rain during the same period in north-west Spain enhances chick survival, by boosting both vegetation growth and invertebrate availability. Obviously, these differences are closely connected with the contrast between a cool, damp climate on the one hand, and a warm, dry one on the other.

Movements

Whilst phasianids are, for the most part, believed to be sedentary, some are known to perform altitudinal movements, and one genus contains migrants and nomads. Species which undertake altitudinal migrations are those which spend their summers high in the Himalayas or the mountain ranges of China and Europe, and descend to winter at lower elevations, below the snow and ice. Long distance movements are recorded only in the quails (*Coturnix*), some of which are considered migratory, whilst others are thought to be nomadic, or their wanderings appear too complex to understand on present information.

Adequately documenting the extent to which pheasants and their allies move up and down a mountainside is difficult. In most cases, it is only possible to make generalizations from records of the altitudes at which occasional observations have been made in various seasons and at various places. Knowledge of the altitudinal range which individuals or even populations inhabit in each season is largely lacking for most species, so an understanding of the timing of such movements is even more remote.

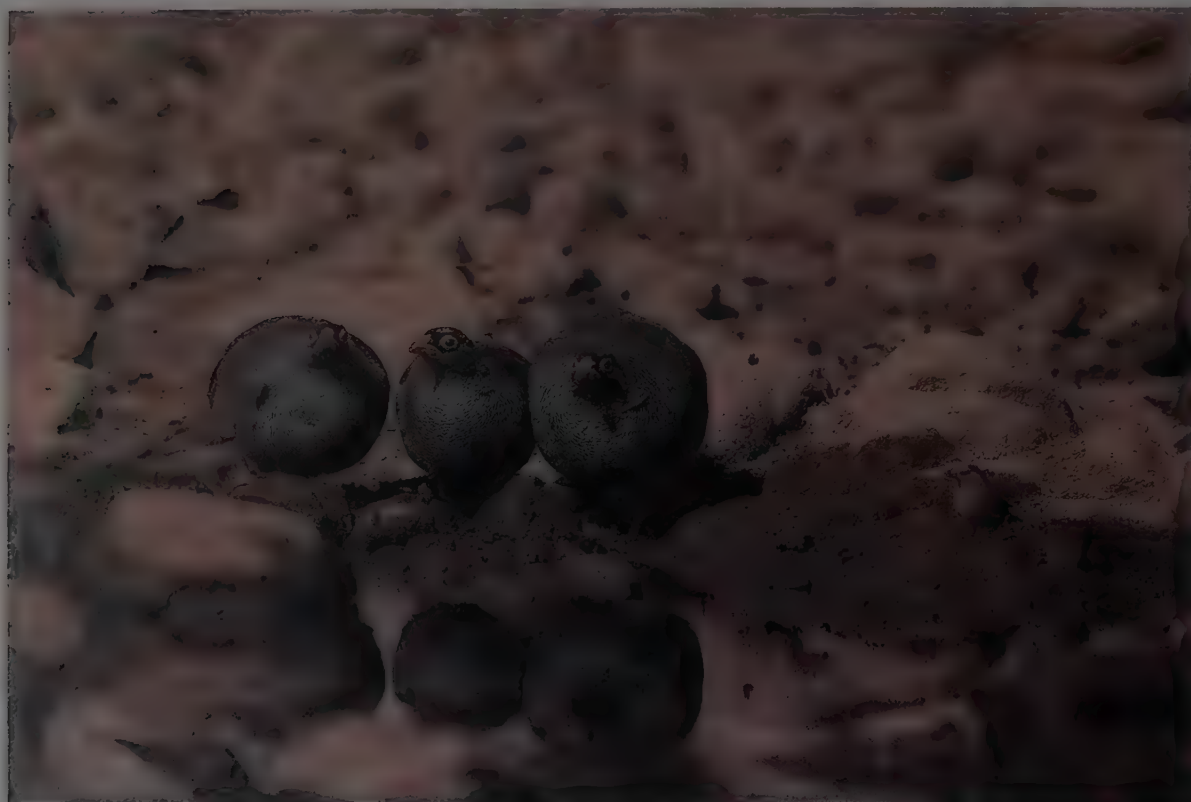
Amongst the studies to have yielded most data on this aspect of phasianid ecology is the Himachal Wildlife Project, a series of surveys led by A. J. Gaston, P. J. Garson and M. L. Hunter between 1979 and 1983 in several parts of the north-west Indian state of Himachal Pradesh. During this project, 73

records of the Himalayan Monal were made between 1800 m and 3500 m. During December and January birds were encountered from 2100 m to 3300 m, with most records above 3000 m. They moved down in February and March, being found as low as 1700 m and up to 2900 m, with most records at 2300 m in the former month and above 2500 m in the latter. There was a considerable upward movement in April, when most birds left the low altitude coniferous forests for the oaks at higher elevations and were spread from 2000 m up to 3500 m, where they reached the tree-line. Continuing to climb, birds venture above the tree-line onto the alpine meadows beyond, during May, when few individuals were found below 2700 m, and most were in the upper forests and areas straddling the tree-line.

Data are lacking for the monsoon-dominated summer months, but the altitude profile in September and October was broadly similar, with something of a shift upwards onto alpine meadows. This suggests that much of the time from May to October was spent above 3000 m, with birds reaching as high as 3800 m. The altitudinal distribution recorded in December and January suggests that there must have been a rather rapid retreat from the high elevations during a short time, between late October and early December, at any rate in this part of the species' range. Overall, inhabiting an altitude range of 1800-3800 m, the birds were found between 2500 m and 3400 m during the breeding season, broadly encompassing the upper part of the oak-dominated forest and the subalpine forest, the exact distributions of which depend on locality, slope and aspect.

A similar pattern of altitudinal movements through the year seems to apply to the Koklass Pheasant too, although only just over one third of the number of records were obtained. Nonetheless, a picture does emerge of several species being forced down by the winter snows, and then following the retreating snow-line upwards again in the spring. Of the pheasants in the region, only Himalayan Monals were regularly found in completely snow-covered areas, and here they appeared to survive by staying near steep, south-facing slopes which would remain under snow for only a short while after a snowfall.

Interestingly, limited information from China seems to suggest that the congeneric Chinese Monal does not descend even



Although it occupies fairly arid habitats, the Red-billed Francolin does not normally stray far from water, as it needs to drink regularly. It visits water-holes or other drinking sites in the late afternoon, when many species of birds and mammals may congregate to drink. Here three Common Grenadiers (*Uraeginthus granatina*) and one Grey-headed Sparrow (*Passer griseus*) accompany the three francolins. Note the finely barred plumage, the red bill and the yellow eye-ring, the main field characters of this species.

[*Franklinia adspersus*, Etosha National Park, Namibia.
Photo: Des & Jen Bartlett/ Survival]

slightly in the winter. The species was found at the same altitude in November and January as in summer, at around 4000 m.

Many other species living on mountain sides occupy upper zones during the summer and descend during winter, when weather conditions make life difficult or impossible at high elevations. Although there is less detailed information available on the extent of the altitudinal movements for these species it seems that some of these local migrations may be quite substantial. For example, the Himalayan Snowcock may climb 1500 m, or even as much as 3000 m, each spring to reach its summer quarters, and the Satyr Tragopan may winter as much as 2000 m below its summer altitudes.

Movements across land and water on a large scale are only seen in the *Coturnix* quails. The only member of the genus that does not appear to move much is the Brown Quail (*Coturnix ypsilophora*), which is believed not to move far from water sources. Otherwise, the genus includes species that undertake regular movements, namely the Common and Japanese Quails, or are partially migratory or nomadic, such as the Rain Quail (*Coturnix coromandelica*) and Asian Blue Quail. By and large, the routes that they follow are poorly known, and such little information that exists points towards a mosaic of complex flight patterns. The migration of the Common Quail, for example, is considered somewhat enigmatic, as it is surrounded by many unanswered questions. It typifies the complexity of the movements of these species.

Although generally reluctant to fly, once the Common Quail is airborne, its flight is swift and direct, two attributes which help it cover large distances, including sea crossings. Some of the birds that breed in Europe may remain as far north as the British Isles and Germany throughout the year, but in general most apparently winter south of the Sahara in arid steppes. Most are believed to winter from Senegal east to Sudan and Ethiopia, a few birds reaching the grasslands of Ghana and Sierra Leone, where the forest belt at the equator is considered to prevent further southward migration. Birds that breed in Africa are thought to be largely locally nomadic in Central Africa, but more regularly migratory in the south, arriving to breed in Natal and Cape Province, South Africa, during the spring months of September and October. They depart for their more northerly winter quarters in northern Namibia, Angola, southern Zaire and west-

ern Zambia in the autumn, although some birds may overwinter in the breeding range, if local conditions are favourable. The irregular movements of the birds in Central Africa may be a response to rainfall patterns, birds appearing after the onset of rains, possibly breeding and departing, but then not returning in similar abundance again for some years.

The migratory routes of the European birds into Africa are intriguing. Southward autumn passage across the Mediterranean Sea peaks in mid-September, birds moving in a broad front and flying but a few metres above the waves. The huge numbers of birds landing within 300 metres of the shore may be heavily trapped in some places, most notably in Egypt. The Sahara is then crossed without a break. Ringing recoveries suggest that there may be a circular route around the western Mediterranean. With some birds breeding around the Mediterranean, and the chance of late influxes into northern Europe, the overall picture is rather confusing. Consequently, it has been concluded that migration routes may vary from individual to individual and from year to year.

Radio-tracking has permitted the ranging behaviour of a few species to be explored. For example, the way in which male Malaysian Peacock-pheasants roam about the forest appears to be different to that of the females. Whereas males seem to be constantly on the move around a home range of up to more than 35 hectares, females stay within a much smaller area of less than 15 hectares. There does not seem to be a predictable daily pattern in which the birds wander around their home ranges, and they may be active throughout the day. Individuals can cover over 300 m in a period of two hours, which would imply that they are not foraging as they go, because the process of scratching at the litter and flicking over leaves takes time.

Predictable daily movements may be seen in many open country species, such as the Stone Partridge (*Ptilopachus pectoratus*), in which birds emerge in the morning to feed, before retiring to shady areas during the midday heat, re-emerging in the late afternoon to feed once more or to drink. Regular daily feeding movements are also reported for some species of grassy or scrubby hillsides, such as the Altai Snowcock, in which the birds fly downhill after calling, only to work their way back up the hillside, whilst feeding.

The snowcocks of the genus *Tetraogallus* are the most vegetarian members of Phasianidae.

Insects form an insignificant part of their diet, even at the chick stage, in contrast with most of the other species, for which insects are important during this early period. The grasses and herbs that grow sparsely on rocky slopes, only slightly below the snow-line, are one of the major resources of the Tibetan Snowcock. This species occurs at greater altitudes than any other member of the family, and it has been recorded at 5800 m in the western Himalayas. The white underparts, with black streaking mainly on the flanks, distinguish this species from other snowcocks.

[*Tetraogallus tibetanus*
tibetanus,
Ladakh, Kashmir, India.
Photo: Joanna Van
Gruisen/Ardea]



Relationship with Man

All the families of Galliformes have been associated very closely with man for much of recorded history. This has primarily been because, as large birds, they make a protein-rich meal, should they be snared, shot or otherwise caught, and also because they lay such big, nutritious eggs. Whether considering the cracids of the New World, the francolins of Africa, the pheasants and partridges of Europe and Asia, or the megapodes of Indonesia and the South Pacific, the Galliformes are unrivalled among birds for their impact on man.

Of these groups, it is perhaps the pheasants which have had the most profound and pervasive impact on man. Their influences have been various, including taking on religious significance in many parts of Asia, providing food and sport, and even sustaining local economies in developed countries in today's world. The reason for this probably lies in the fact that a few species were hardy enough to live in close proximity to man, and even to be kept, with the result that they became intimately known. Not only would these few species stay close to human settlements, but they would also survive long journeys across land or sea. In addition, the females would produce yet more food at regular intervals in the shape of eggs! Consequently, some of these birds were well known outside their native ranges long ago, and they seem to have become important to man wherever they have been taken.

Some pheasants were well known over 3000 years ago, when they were depicted in embroideries and paintings in China and elsewhere. Ancient Greeks, like the playwright Aeschylus, knew of the Ring-necked Pheasants of Colchis, and the Indian Peafowl featured in Sanskrit writings and Greek mythology. Many pheasants, francolins and partridges have long been snared, for food, providing a varied diet for the peoples of parts of Thailand, China and the forests of south-east Asia and the Congo, amongst others. Whether or not these birds have been exploited as a food source has depended to some extent on religious beliefs. For example, the many francolins, quails and guineafowl (Numididae) present in the Horn of Africa are believed to benefit from the non-hunting beliefs of both Christians and, to a lesser extent, Muslims, and the ground-dwelling forest wildlife of Bhutan

in the east Himalayas is still rich thanks to the Buddhist tradition of that country.

Of all the birds, if not all the animals, known to man, the species which has had most impact on many varied aspects of human life is, without doubt, the Red Junglefowl. As the domestication of this species has featured so prominently in human history, it is worth exploring this association in some detail. The association arose and has flourished essentially because time and time again the domestic fowl has provided a living and reproducing source of food for seafarers and colonizers, but also because it has stirred a wide range of fears, hopes and emotions, it has been invested with religious symbolism, and it has provided sport and recreation of various kinds.

Indeed, the intimacy with which man has been associated with the domestic fowl is indicated by the influence that it has had on language the world over. In English, for example, there are many words or phrases referring to the strength, aggressiveness and strutting nature of the cock fowl. Indeed, the word "cocky" meaning impudent or cheeky is derived from the appearance that a displaying cock gives, and the word "cock" itself, meaning to place upright or rise, is again derived from the impression of swelling up or becoming taller that a cock fowl gives when beginning to display. "Cock-a-hoop", "cock-sure" and many other phrases are rooted in this expression of strutting, confidence and arrogance, with no cause for concern about daily matters. When "chicken" or "chicken-hearted" is used to mean cowardly, it refers to the impression gained long ago that young domestic fowl appear very timid and run towards the hen at the slightest hint of danger. Traditional Malay sayings, of which there are plenty making reference to chickens and other pheasants, include *seperti ayam di-makan tungau*, "like a fowl plagued with fleas", to describe someone who is sickly, and *bagai kuang memek di-puchok gunung*, "like an Argus Pheasant calling, away on a mountain top", referring to the hopeless longing of a despairing lover.

Whilst the Green Junglefowl of Java has, on occasion, been thought the ancestor of the domestic chicken, there is strong evidence to suggest that it is actually the widespread Red Junglefowl that is the progenitor of the bird that is now such an important part of human life everywhere. When and where the wild Red Junglefowl was first kept for mankind's benefit is,



During the breeding season, male Indian Peafowl establish small territories in which they perform their well known courtship display, erecting and fanning the train in front of the female. Normally, several dancing grounds of different males can be very close to one another, resulting in frequent territorial intrusions. When these occur the owner defends his territory fiercely, at first with threats, but if these do not work, through vigorous fighting.

[*Pavo cristatus*,
Ranthambhor National
Park, Rajasthan, India.
Photo: Günter Ziesler]

however, less clear. The uncertainty over the date at which this first happened is summed up by W. Beebe, who wrote, "Somewhere in the far distant past, exactly when we shall never know, some primitive race of mankind captured living junglefowl and tamed them". It seems that the junglefowl was kept by the civilizations which inhabited the the Indus Valley in the third millenium BC, and India, rather than the areas further to the east in south-east Asia, is most probably the original centre of domestication. These Indian settlements were centred on two capital cities which lay along the Indus River, Harappa to the north, on the Ravi River just above its confluence with the Indus, and Mohenjo-Daro in the plains to the south. These civilizations, which were to remain unequalled in India for their civic organization until modern cities appeared, also had domesticated sheep, goats and pigs, as well as buffaloes, camels and elephants.

Piecing together what is known about the journey of the domesticated chicken through both time and space tells a revealing story about the history of mankind's travels and exploration, as chickens, once identified as a source of food, accompanied these voyages everywhere. Not long after the domestication of the fowl in the Indus Valley, it appeared in Persia and spread through Crete and Phoenicia, which is now primarily coastal Syria, to central and north-western Europe, where it had arrived by 1500 BC. Further south, the keeping of domesticated chickens spread somewhat more slowly through the western part of the Mediterranean from Greece. Domestic fowl were present in both Egypt and China by 1500-1400 BC, although they were possibly not commonly kept in the former until several centuries later.

It seems, therefore, that chickens were kept by people throughout many parts of the world by the first century AD. Red Junglefowl were already on the South Pacific islands by the time that European settlers first visited them. It is believed that early Pacific seafarers took chickens with them on voyages throughout the Micronesian, Melanesian and Polynesian islands. During these trips, which were probably undertaken mainly to colonize new islands, village chickens were kept and some of them became feral on most of the islands that were visited. They were found on the Mariana Islands at the time of Magellan's voyage in 1521 and were common in the wild on

the coral island of Tinian in the south of the Mariana chain by the time Pascoe visited it in 1742. South-east of the Marianas, domestic fowl had probably been taken to the Santa Cruz Islands, to the north of Vanuatu, by 1565, and they were noted by Quiros on the Marquesas in 1595. In the following two hundred years, explorers such as Cook, Gonzales and Bligh reported that they were already found throughout the Pacific islands. Now there are Red Junglefowl living wild on many of these islands. They were taken to the Americas by Europeans, Columbus taking these birds with him on his second voyage to the West Indies in 1493, and many tribes in South America have long raised domestic fowl.

Why have the fowl lent themselves to such close association with man? There are, perhaps, three attributes of Red Junglefowl that particularly attracted mankind to them so early. In the first and most significant instance, they provide a rich source of food, as both the flesh and eggs were found to be edible, and through breeding particularly good birds and feeding them well, man found that either large birds or those which laid many eggs could be produced. Without doubt, this was the main driving force in their domestication. Secondly, once they were domesticated it was realized that the aggressiveness of the males could provide exciting sport, and, as a result, cock-fighting has long been practised in many parts of the world. Finally, in some areas, the breeding of all manner of different types of domestic fowl has been so popular that many breeds of poultry of all shapes and sizes have been produced. Now, these birds are bred for exhibition and are exhibited in a great variety of shows.

Not only have domestic fowl been taken to more parts of the planet than virtually any other animal, but they have also entered into a great many aspects of human life, invoked as guardians of spiritual and physical well-being. Whilst continuously being exploited, they have been variously admired, feared, revered, or viewed with suspicion throughout their association with man. Al-Qazwini, a thirteenth century ad Arabic writer, for example, wrote that, "the cock is the most lustful and vainest of birds...One of the strangest things about it is that it knows the watches of the night, and apportions the times for its crowing according to the length or shortness of the night...". He goes on to say that a white cock which has a divided comb



The Ring-necked Pheasant tends to initiate its territorial activity in spring, when males start to patrol their prospective territories. Calling becomes more regular and more frequent as the season progresses and the territories begin to take shape, and soon territorial disputes between neighbouring males are rather common, as they attempt to establish the precise limits of their property. Such disputes often start with the birds facing each other and sometimes walking along together, with the neck feathers bristled up and the red wattles swollen to dramatic effect. Threat calls are made, and violent jerks of the head may follow, as may a certain amount of aggressive grass-pulling. If this is not enough to decide the quarrel, a fight can break out, the birds jumping at each other and trying to take a bite at each other's wattles, or kicking out with the claws and spurs. After a brief struggle, one of the birds usually gives in and departs, hotly pursued by his victorious opponent, but very occasionally one of the birds may be killed.

[*Phasianus colchicus*.
Photos: Gary W. Griffen]



"Wing-whirring" is the name given to an action whereby a bird produces a whirring noise by beating its wings very fast, so as to cause vibrations. It is one of the most characteristic elements in the courtship display of male gallo-pheasants (*Lophura*), which also use it as a means of challenging other males and as a warning. In the Silver Pheasant, "Wing-whirring" by the female is also common and it has been suggested that it may be used like a contact call, for reassembling the members of a family group.

[*Lophura nycthemera*.
Photo: Kenneth W. Fink]

will keep the Devil away from the house in which it dwells, and that slaughtering such a bird leads to loss of wealth and suffering. Earlier than this, in about 300 bc, it was written in India that man can learn four things from a cock, namely to fight, to rise early, to eat with his family, and to protect his spouse when she is in trouble.

Many medicinal benefits have been attributed to the cock at various times in history and in various parts of the world. A drink comprising the dried and ground comb will, when taken, force all bad habits to leave a man, and the smoke given off when drying the comb will benefit a madman. More specifically, poor sight can be improved by applying to the eyes a salve made from the gall, especially if the gall is placed in a silver vessel and applied continuously. The gall was also reputed to recover memory loss, if it was mixed with mutton broth and taken in the morning on an empty stomach. Binding the wing to a fever-stricken patient cures the sufferer, and the wing will also give a rider boundless energy when attached to his loins. The blood can be beneficial or detrimental. If extracted during a cock-fight and mixed with food, those that consume it will argue amongst themselves, whereas if blood is mixed with honey and warmed on a fire, such a concoction will increase a man's virility.

The cock has also been of great religious importance throughout its association with mankind. To the Zoroastrians of ancient Persia, who were known as fire worshippers, the cock was an object of sacrifice. The Greeks dedicated the cock to three Gods: to Apollo, as it heralded the rising of the sun; to Hermes, because its crowing called men to work; and to Aesculapius, because of the virtues of retiring to sleep and rising early. In the thirteenth century, the aforementioned Islamic writer Al-Qazwini, stated that God "has created a cock beneath his throne, with wings that can extend beyond the East and the West; and towards dawn he spreads his wings and flaps them, and raises his voice in praise of him". When this cock stops crowing, the day of judgement is at hand. Believed to have been introduced to Palestine by about 200 bc, there are but one or two dubious references to the cock in the Old Testament of the Bible, whereas both the New Testament and the Talmud carry references. In the New Testament, the cock crowing at dawn was used to keep time, as when Peter denied Jesus

three times and then heard the cock crow and was filled with anguish. Traditionally the cock has been the sacrificial animal of the Jews, being an atonement offering at Yom Kippur, a man giving a cock, and a woman a hen. The cock was used to ornament Gothic churches as it was the standard of war to the Goths.

The importance of domestic poultry as a food source throughout the world is illustrated by the scale of the industry in the United Kingdom. During 1993, over 30,000,000 chicks were installed to produce eggs for consumption, about 650,000,000 chicks were destined to be reared as table birds, and in the region of 850,000,000 eggs were put into incubation to be raised as breeding and multiplying stock. These figures indicate exactly how significant a part of man's diet the descendant of the Red Junglefowl has become.

Whilst in earlier times the cock was believed to have many medicinal properties of its own, its contribution to modern medicine is as a model for scientists to try and understand some of the formative processes in the brain, such as vision, learning and memory. Rather than being of direct use to medical research, it is used for investigating basic biological questions concerning the formation and functioning of brain processes.

Domestication of the Red Junglefowl has had an impact on mankind that is impossible to overestimate, but it is not by any means the only member of this family to have had a major influence on people in different countries.

The Chinese have a very close relationship with many species of pheasant. The Brown Eared-pheasant is considered a symbol of bravery because of the battles that the males fight. Indeed, the generals of most emperors from the times of the Warring States, in 475-221 bc, to the Qing Dynasty, AD 1644-1911, placed the tail feathers of this pheasant in their helmets. The Rooster, inevitably once again referring to the descendant of the Red Junglefowl, is the only bird included among the twelve animals of the Chinese Zodiac, in which each animal represents a Chinese year in a twelve year cycle. The Rooster symbolizes the five virtues of being a good omen, authoritative, courageous, good and confident. It is a good omen because of the bearing with which it carries itself, its comb lends it authority and the spurs show its courage. It is good because it always shares its food, and finally the assurance with which it

The male Himalayan Monal is one of the most admired of all pheasants, perhaps mainly because of the metallic gloss of its brightly coloured plumage. In its courtship display, as performed by this bird, the golden orange tail is raised and spread, the purplish blue wings are lowered to such an extent that the feet and legs are completely hidden, the feathers of the mantle and neck are fluffed out, showing the beautiful metallic colours to their best advantage, and the long crest, formed by a tuft of racket-shaped feathers, is erected. The bird holds this position for a few seconds, motionless apart from slight movements of the head which make the crest shimmer and quiver.

[*Lophophorus impejanus*,
Sagarmatha National
Park, Nepal.
Photo: Joanna Van
Gruisen/Ardea]



greet the sunrise indicates its confidence. To celebrate the last year of the Rooster, 23rd January 1993 to 9th February 1994 in the Gregorian calendar, the Beijing Natural History Museum mounted an ambitious exhibition to show how important this species, and the other Galliformes, have been to man, and to highlight the plight of the Chinese species, in particular.

By and large not used by man as a staple source of food, not widely used for medicinal purposes or sport and hardly ever viewed with fear or superstition, the Indian Peafowl has mostly been admired for the beauty of the male. Reference of the Indian Peafowl does not seem to go back as far as does that of the Red Junglefowl. Although it is constantly referred to in Indian mythology and Sanskrit writings, the first mention of the bird outside India was not until the time of Solomon. His Phoenicians, voyaging to the coast of India, brought the Indian Peafowl back to the Syrian mainland, and also to the Egyptian Pharaohs.

Subsequently, the early Greeks described how the train of the peacock became covered with the eye-like ocelli. The god Argos, whose body was covered with eyes, had been told by Hera to watch Io, who had been turned into a cow, but he was killed by Hermes when carrying out this duty. Hera then took Argos's eyes and put them onto the peacock's tail. The species was not widespread in Greece until Alexander the Great brought it back from his travels in the latter part of the fourth century BC, but, according to Aristotle, it then spread rapidly. Alexander was so struck by the male's beauty that he imposed a severe penalty on anyone caught doing it harm. Referring to its calls, however, Aristotle quotes Aldrovandros, who wrote that "though he be a most beautiful bird to behold, yet the pleasure of the eyes is compensated with many ungrateful strokes upon the ears, which are often afflicted with the odious noise of his horrid cry".

In its Indian homeland, the peacock is sacred to the Hindus as it is the vehicle upon which rides the god Kartikeya, son of the Lord Shiva and Parvati, and brother of the elephant-headed god Ganesh. There is considerable folklore associated with the peafowl across the length and breadth of India. It is considered one of the main destroyers of snakes as it is able to hypnotize a snake and addle its eggs, and, in one of the few medicinal qualities accredited to peafowl, the flesh of a peafowl can be

taken to help cure a person bitten by a snake. In Sri Lanka, Singhalese medicine has used the fat as a cure for rheumatism, sprains and dislocations, and the ocelli-bearing feathers fight diseases of the eye, while the ocellus itself, when smoked, is an antidote to rat-bite.

Outside India, the fact that the peacock has been considered a bird of great beauty and magnificence has led to its symbolizing wealth and power. For example, during Roman times, a successful breeder of peafowl could make quite a living providing birds for the table of lavish feasts, at which peacock's tongue was considered a delicacy. In England in the Middle Ages, barons served up roast peacock at their banquets to prove their wealth, and the lawns of stately homes resounded to the call of the free-ranging peacocks.

As well as using the Indian Peafowl as a symbol of their wealth, members of the British aristocracy in the Middle Ages demonstrated their status by hunting other phasianids, most notably the Ring-necked Pheasant. Native to the Eastern Palearctic where it is distributed from the eastern shores of China west to the Caucasus Mountains, it is commonly called simply the Pheasant, or the Common Pheasant, in most of its introduced range, as it is the only member of the subfamily to occur in most regions outside Asia.

The Ring-necked Pheasant is alleged to have reached Europe, when Jason brought it back on the Argo after his search for the Golden Fleece. Indeed, the scientific name of the species honours the supposed locality of these birds, along the River Phasis in the land of Colchis, a region of the Caucasus, although it has also been suggested that the Romans were the first to make mention of the pheasants in this region. The Romans may have introduced pheasants to Britain, Italy, Germany and France, from where the many recipes indicate that they were avidly sought after for their exquisite taste. Within the last 300 years, the Ring-necked Pheasant has been taken to much of Europe, North America, some Australian islands and New Zealand, among other areas.

Whether the species was introduced into Britain by the Romans or much later during the Norman conquest, it was certainly established and breeding in the wild by the late fifteenth century. It was granted some degree of protection by the Royal Courts. Charles II, for example, only allowed



The courtship display of the male Bulwer's Pheasant is the most elaborate of all in the genus *Lophura*. The tail, consisting of 15-16 pairs of long, broad, curved snow white rectrices, is spread and arched high over its back, almost until it touches the neck, while the outer 6-7 pairs of rectrices are drooped down, so that their bare quills scrape the ground, producing a rustling noise as the bird moves forward. The bright sky blue face wattles in their normal state look like those of other *Lophura* species, but now they are greatly distended and stiffened, forming a ribbon-like, curved band about 18 cm long, broken only by the crimson eye, which stands out all the more because of the eye-ring of the same colour.

[*Lophura bulweri*.
Photo: Kenneth W. Fink]

the richest 5% of landowners to hunt anything at all, and imposed quite harsh penalties on lawbreakers. Needless to say, these rights were earnestly sought after and, if obtained, jealously guarded.

For many years after the establishment of the pheasant as a gamebird, the prestige, by implication of wealth, associated with shooting meant that the habitat in which the pheasant thrives was protected. Indeed, it has been suggested that the popularity of a day's pheasant shooting has played a major role in the preservation of lowland woodlands in southern England. This is because large estates, under ever-increasing pressure to make every acre of land pay, would have turned over all the land to agriculture of one sort or another, if the pheasant habitat had not been able more or less to pay its way. These pressures may well have been greatest, when, after the rationing imposed because of food shortages during the Second World War, the British Government sought to make the country self-sufficient.

The money spent on managing British Ring-necked Pheasants now reflects their importance to some rural economies. This species was the subject of a very large part of the staggering £400,000,000 that is estimated to have been spent on game shooting in 1981. At present, this is equivalent to somewhere in the region of ten times the amount of money that the British Government's conservation department has to spend on all of its activities in a year. It seems quite remarkable that ensuring that a single species of pheasant is alive and well can be so important to the economy of an industrialized country.

The Grey Partridge has also been shot in Europe since the Middle Ages. Inhabiting open landscapes, it now depends largely upon sympathetic farm management of areas dominated by fields of cereals. The drive towards intensification of farming practice has caused a marked decline in numbers of this species throughout its range.

The amount of research that has been conducted on these "game" species gives a good indication of the amount of money spent on game shooting. Both the Ring-necked Pheasant and the Grey Partridge have, for many years, been the subjects of various management-related research projects, and are the subjects of authoritative books written recently, largely summarizing the work undertaken by The Game Conservancy

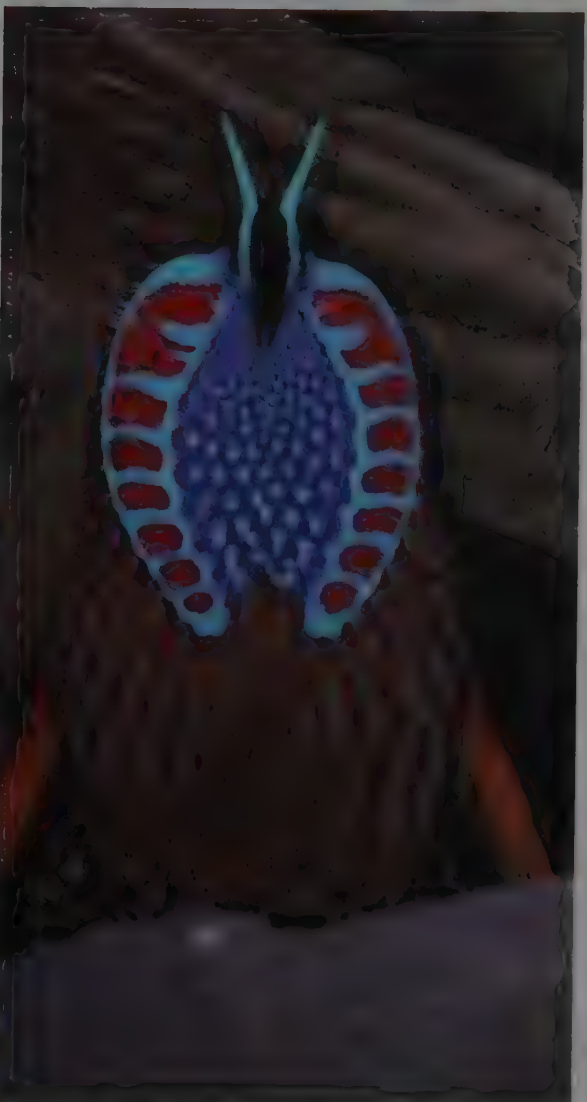
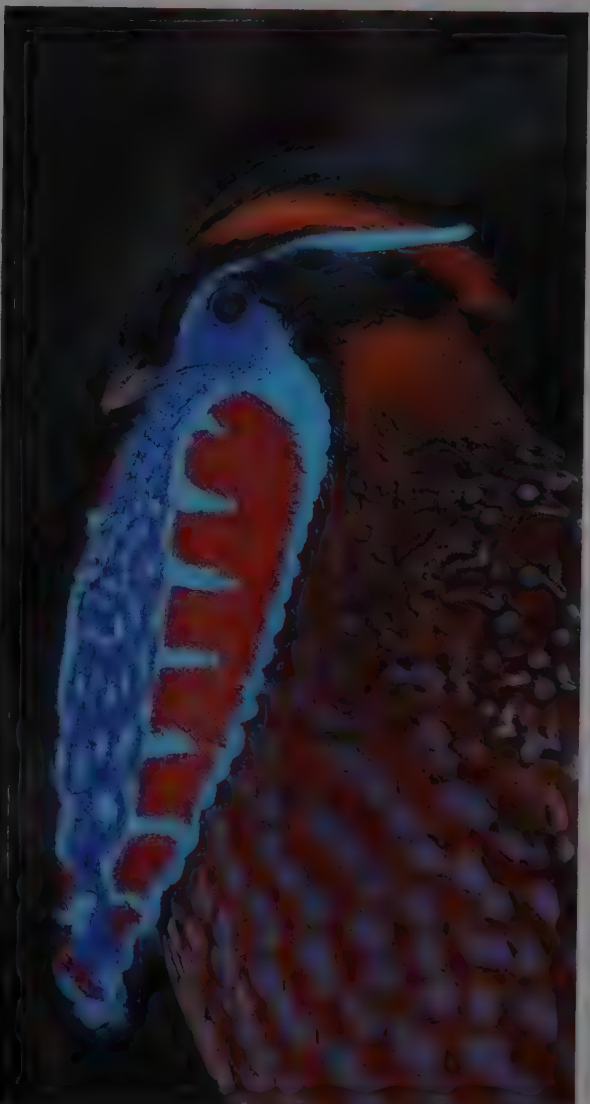
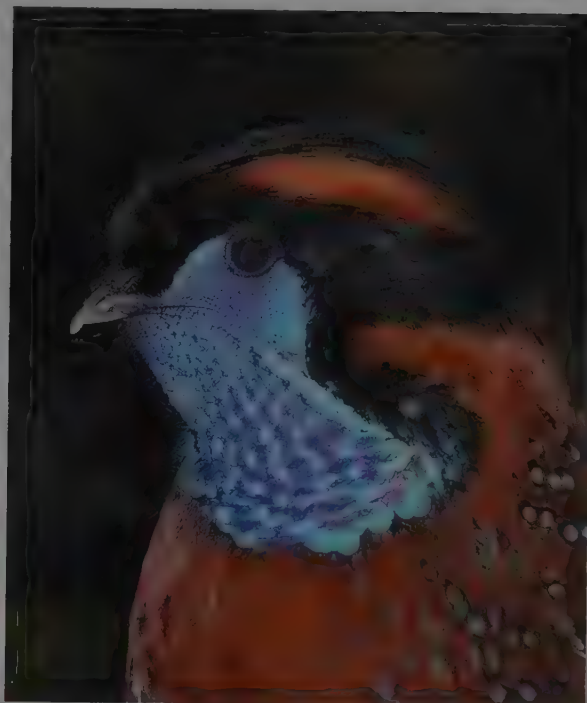
Trust in Britain. The Grey Partridge has one of the longest research pedigrees of any bird anywhere, having been the subject of intensive research since 1930, perhaps surpassed only by the Red Grouse (*Lagopus lagopus scoticus*), on which research began in 1905.

The aim of much of this research has been, and still is, to understand the processes that govern the species' lives and influence their numbers by affecting reproductive success, recruitment and survival. Ultimately, this research aims to propose how the habitat of these species can be managed to increase the numbers of birds surviving. Research programmes are increasingly designed to reconcile the demands of ever more economically orientated land managers, and the conservation requirements of both species and habitats.



The Mountain Peacock-pheasant is one of the latest species to have been successfully reared in captivity for the first time. It was almost unknown in collections until the end of the 1970's, but breeding success in Hong Kong and Malaysia has led to the establishment of a small population, which was estimated to number 111 birds in 1993. In its lateral display, the male walks daintily around the hen, offering a frontal view of its broad, graduated tail, which is decorated with numerous metallic green patches.

[*Polyplectron inopinatum*.
Photo: Kenneth W. Fink]



Of all the varied types of head adornment worn by the males of most pheasant species, the lappets exhibited by the tragopans in their courtship displays are amongst the most peculiar. The elaborate pattern of the lappet varies from species to species, and one of the largest lappets, that of Temminck's Tragopan, is dark blue in the centre spotted pale blue, with eight scarlet markings down each side.

Normally, the lappet is completely retracted and remains practically invisible, but during display it is suddenly expanded down over the breast, forming a bright, bib-like flap that is exposed in front of the female. At the same time, the male adopts an upright position, with its wings lowered and half spread. At the climax of the display, the bird dramatically erects two small, fleshy blue horns, which in normal condition are shrunk and concealed beneath the crown feathers. After a few seconds, both the lappet and the horns are quickly deflated and the bird resumes its normal aspect.

[*Tragopan temminckii*.

Photos: Kenneth W. Fink]

Treating a bird species as a crop to be harvested is somewhat controversial, although there is always the argument that the money spent on shooting pheasants has saved much of the ancient oak and beech woodland, at any rate in England. On a global scale, harnessing this interest in hunting wild species may offer long-term survival prospects for a number of species and their habitats. The rationale is that if there is sufficient interest in hunting for sport, then sustainable practices can be adopted so that both the habitat and the hunted species are conserved to allow hunting to take place. The income generated by shooting should then provide money badly needed for conservation. It is an emotive issue, however, and some Galliformes are likely to be considered ideal for this practice, because of their size, ground-dwelling nature and palatability.

In Zimbabwe, for example, hunting of gamebirds has not required a licence since the Parks and Wild Life Act was passed in 1975. Recently, management recommendations have been made that should ensure that hunting of the country's terrestrial birds is sustainable. The species concerned include seven francolins, especially Swainson's Francolin, and the Harlequin Quail; the recommendations are currently being tested.

In South Africa, the hunting of species, other than those traditionally regarded as "Big Game", is becoming very popular. In the eastern part of Cape Province, on the Stromberg Plateau, hunting of the Grey-winged Francolin has become a commercial proposition over the last ten years. Other species which are shot, though rather less systematically, include Swainson's Francolin, the Crested Francolin (*Francolinus sephaena*) and the Natal Francolin (*Francolinus natalensis*). The formation of the African Gamebird Research, Education and Development Trust, known as AGRED, is the result of those interested in hunting in South Africa joining together in an undertaking to ensure that gamebird populations are sustainably managed in the country. The 2,000,000 Rand, or so, that this young industry is now generating for cash-starved rural areas each year may point the way towards conservation that is economically viable.

This concept of sustainably harvesting species has been termed "Wise Use". The essence of this approach is to try to ensure that there is an economic incentive to conserving species and their habitats. Two examples may illustrate this. It seems that, at any rate in much of its range, Grey Partridge numbers

The fantastic courtship dance performed by the male Great Argus is one of the wonders of the bird world. The display begins when a female enters the arena, a patch up to five metres wide which has been cleared by the male. At first, the male circles round the female ceremoniously, coming closer and closer, until he suddenly thrusts his wings wide open and inverts them, with the primaries spread forwards touching the ground, the inner secondaries meeting at the top, and the entire expanse of the wings curving upwards and around to form a huge funnel, in which the ocelli of the secondaries are prominently exposed. At the same time, keeping his head and neck hidden from view, the male waggles his tail back and forth and vibrates his plumage so as to produce a rustling sound.

[*Argusianus argus argus*.
Photo: Kenneth W. Fink]



A number of specialized displays can precede copulation in the Ring-necked Pheasant, amongst which the most important are probably "Lateral-displays", with the male strutting round the female, spreading his tail and drooping a wing towards her, and "Tidbitting", which involves calling and offering food to her. If receptive, the female will squat, inviting the male to mount her, and copulation follows. In the latter part of the breeding season, copulation often takes the form of "rape", as the male forces himself upon the female, grasping her nape feathers with his bill; males that do not hold territories are probably able to copulate only by means of rape. In the moments surrounding copulation, the male's red face wattle and ear tufts are noticeably swollen.

[*Phasianus colchicus*.
Photo: Gary W. Griffen]



are highest where the economic incentive is enough to justify the cost of habitat management. Similarly, in Zimbabwe, it has been seen that if local people are assured of meat and money, they are prepared to look after wild species for sport hunting. This general approach has now been accepted as having the potential to show the way forward for the conservation of some species that are closely linked with man. Typically, these are species that are exploited in various ways, whether it be on a small scale or at a massive, unsustainable level, and many phasianids, as well as other Galliformes, are subject to these direct forms of human exploitation. Promoting such wise use of animal and plant species is the remit of the Specialist Group on the Sustainable Use of Wild Species, which operates under the auspices of IUCN's Species Survival Commission.

In addition to the importance of phasianids as gamebirds, some species have also been amongst the most typical ornamental birds, due to their spectacular beauty (see Morphological Aspects). In addition to the esteem bestowed upon the Indian Peafowl, there are many other species which have long attracted man through their striking appearance. It is the pheasants more than the partridges, quails, francolin and snowcocks that have captured the imagination, undoubtedly because the pheasants are larger and, in general, more colourfully adorned than most perdicines. Ornamental pheasants have been sought so that they may be exhibited in both public zoos and private aviaries, or to wander freely across the lawns of large houses, as vivid adornments. The extravagant plumes of some species are of cultural importance in several areas. For example, the magnificent tail feathers of Reeves's Pheasant, which may reach 150 cm in length, have traditionally been used to adorn headdresses in Peking Opera. Nowadays, plastic imitations are used, which is a blessing for a species that is very reduced in numbers in the wild, and is now found in fragmented populations. Similarly, the train feathers of the Green Peafowl are used in Javanese dances.

The leisurely appreciation of these fine birds appears to have been of Western European origin, as the aristocrats of several countries employed collectors and dealers to bring back

examples of the many dazzling animals that were to be found in countries which at the time made up the empires of the European powers. The aristocrats who maintained collections during the late nineteenth century in Paris and London were continually sent new pheasants. Indeed, the 1860's and 1870's must have been especially exciting times, as many species new to science were dispatched live to Europe to be paraded before the public, and widely admired.

Apart from the Red Junglefowl, Ring-necked Pheasant and Indian Peafowl, the first pheasant recorded alive in Europe was probably the Golden Pheasant, kept as early as 1740, when Albin reported in his *Natural History of Birds* that several were in the collections of "our nobility and some curious gentlemen". The Grey Peacock-pheasant soon followed, judging by the paintings made of pheasants present in Mr John Munro's collection in London during 1745. Subsequently, Reeves's Pheasant was kept in Macao, China, by an Englishman by the name of Beale in 1808. Reeves himself bringing one of the cocks to Europe in 1831 and describing the species. The Green Peafowl appeared in aviaries in Cape Town, South Africa, in 1813, sent from Macao, and reached Europe in 1831, by which time Lady Amherst's Pheasant had also arrived. This last species only survived for a short time in London Zoo, having been kept in India for two years prior to shipment to England. In the mid-1920's the King of Ava presented two males from the mountains of Cochin-China to Sir Archibald Campbell, who passed them on to the Countess Amherst.

These occasional importations were nothing compared to the influx of new species that took place during the second half of the nineteenth century. In 1872, D. G. Elliot prepared the first monograph of the pheasants, a work which contained some exquisite hand-coloured reproductions of watercolours painted by J. Wolf. Although not all the pheasant species had been described when this work was published, privately, by Elliot himself, it is a marvellous celebration of the beauty by which this group of birds has entranced man.

The keeping of pheasants, and to a lesser extent partridges, quails, francolins and snowcocks, has become



The nest of the Red-legged Partridge is a simple scrape on the ground lined with some plant material, usually sheltered by grass tussocks or a bush. The nest is constructed by the male, and he will sometimes make more than one, at different sites, for the female to choose from. The eggs, normally 10-16, are cream-coloured, finely spotted reddish brown. Incubation lasts 23-24 days and is carried out by the female alone, although the male will sometimes sit on the nest at an early stage when there are still only one or two eggs. The female sometimes lays a second clutch in another nest a few days after finishing the first, in which case this second clutch is incubated simultaneously by the male alone.

[*Alectoris rufa*.
Photo: Brian Hawkes/
NHPA]

increasingly widespread since those early days, when it was the exclusive preserve of wealthy naturalists and the like. Virtually all species of pheasants, and many perdicines, are now maintained in captivity in many countries. The appeal of this family to such a great number of people has resulted in many species being widely bred. Indeed, there are far greater numbers of most of these species in the collections of private aviculturalists than there are kept publicly, in zoos and bird gardens. Whilst it is increasingly realized that these captive collections must be properly managed if they are to contribute to the long-term conservation of the members of this family in the wild, most private aviculturalists began to keep these birds simply because of their beauty and some of their habits.

Being able regularly to see and appreciate such beauty and elegance appeals to the sense of the aesthetic; it is an aspect of man's relationship with the family that is impossible to quantify, but in some ways it is as important to man as the chicken's flesh. The struggle for conservationists is to ensure that these birds survive for the future, a considerable task (see Status and Conservation).

Status and Conservation

Many species of pheasant, partridge, quail, francolin and snowcock are believed to be threatened with extinction. In some cases, such as that of the Himalayan Quail (*Ophrysia superciliosa*) and Edwards's Pheasant, this may be mean that extinction in the wild has recently taken place, but has yet to be proved. At the other end of the scale, it may indicate that widespread and numerous species are almost certainly suffering such a rate of population decline that there is a chance that they will become extinct during the next 100 years. An example of the latter case is that of the Great Argus, a large-bodied inhabitant of lowland tropical rain forest in the Malay Peninsula, Sumatra and Borneo. This habitat was once distributed continuously throughout the region, but its loss to logging, and land clearance for other reasons, has probably caused a sharp decrease in the numbers of this species, and of other sedentary lowland forest specialists, over a relatively short period of time.

A continued decline in the population at the current rate is sufficient reason to be concerned for the long-term survival of the Great Argus.

Because so many of the species in this family are very poorly known, particular efforts have recently been made to collect information on their current status and conservation needs, so that the extent of any threats to their survival can be assessed. This onerous task was undertaken by the World Pheasant Association, and centred on a Conservation Assessment Workshop held at Antwerp Zoo in February 1993, a meeting co-organized by BirdLife International and the Captive Breeding Specialist Group of IUCN's Species Survival Commission, in addition to WPA. This is the first time that data on all phasianid species have been sought out and gathered together, to allow the systematic appraisal of whether or not a species is threatened, and, if it is, how immediate that threat may be. Other families included were the Odontophoridae, the Numididae and the Megapodiidae.

Many previous considerations of the status of birds have been based on a starting point that a species is known to be facing problems, with the result that those species that are not subject to obvious pressures are easily overlooked. In order to avoid this pitfall, the Conservation Assessment of the phasianids considered all species, whether traditionally thought to be at risk, such as the Western Tragopan, or not, as with many of the African francolins.

An important product of the workshop was the assignment of a Mace-Lande threat category to all species, and distinctive subspecies or subspecies clusters (see page 19). These threat categories are an attempt to improve upon the subjective nature of the existing IUCN threat categories, and are still being refined. In some cases morphologically distinct and geographically isolated subspecies, or subspecies clusters, were treated separately and assigned a threat category accordingly. For example, the Silver Pheasant, while thought to be safe from extinction, contains several subspecies which are believed very much at risk, such as the race *engelbachi* from the Bolovens Plateau in southern Laos, and the Hainan endemic *whiteheadi*, both of which are endangered. In all, the 155 species in Phasianidae were treated as 181 distinct taxa, made up of 69 pheasants and 112 partridges, quails, francolins and snowcocks.

Grassland and cereal crops are amongst the habitats most commonly used by the Stubble Quail, and, as they provide both food and adequate cover, they are also suitable areas for nesting in. The nest is a scrape in the ground which the female digs with her feet; it is lined with dry grass or loose bits taken from the surrounding vegetation. The female also takes on the task of incubation, which begins only once her full clutch, usually numbering 7-8 eggs, has been laid. This is important in order to ensure that the precocial, nidifugous chicks hatch synchronously. Note the thin dark moustachial stripe of the female, a feature absent in males of this species.

[*Coturnix pectoralis*,
Victoria, Australia.
Photo: I. R. McCann/
ANT/NHPA]



All subsequent reference to status in this section refers to the Mace-Lande category.

There were three important outcomes of this exercise: the parts of the family's range that contain most threatened taxa were revealed; the nature of the threats facing these birds were identified; and, thirdly, a much clearer indication of the species' conservation needs and priorities emerged. Plans for conservation action have been based upon these results.

A glance at the distribution of the threatened taxa, both within their respective subfamilies and geographically, is revealing. One pheasant taxon may be extinct, two are critically threatened, 18 may be endangered, and a further 24 vulnerable. There is insufficient information available to determine the status of five taxa, and 20, a mere 29%, are considered to be safe from extinction. The *Perdicinae* are, as a whole, in better shape, although again one taxon may be extinct. Two taxa are critically threatened, nine endangered and 20 vulnerable. Five taxa are too poorly known to permit any assessment of their status, and 75, representing 67%, are relatively safe at present.

The higher proportion of *perdicines* that are safe from extinction when compared with the pheasants appears attributable to their respective patterns of distribution. The pheasants are almost exclusively Asian in distribution, containing many forest-dwelling species, especially in the tropical forests of south-east Asia. In contrast, a higher percentage of *perdicines* occurs found in the open areas of Africa and the Palearctic, and these species are often tolerant of some forms of habitat alteration, inhabiting overgrown cultivation, or even moving into fields and plantations in some instances. Many of these open country species have far more extensive distributions, often occupying more than half a million square kilometres. In contrast, the forest-bound taxa, particularly in the tropics, appear to have very specific habitat requirements, and have much smaller ranges as a result. Indeed, many forest-dwelling phasianids are considered Restricted Range Species by BirdLife International, as they have ranges of under 50,000 square kilometres. In support of this, of all Phasianidae, *Numididae* and *Megapodiidae* considered at the Antwerp meeting, 80% of the African taxa are thought to be safe from extinction, whereas in the Indian Subcontinent the figure is 52%, in China 48%, and in south-east Asia 40%. Thus the threats facing the family are

greatest in the forests of south-east Asia, the Himalayas and China, with the larger-bodied pheasants at greatest risk.

The proportion of species in Phasianidae that are threatened as a result of man's activities is amongst the highest in any bird family, and the Galliformes are among the most threatened of orders, in terms of proportion of species threatened. Part of the reason for this is the close relationship that man has had with the phasianids. Whilst the three species which are most celebrated for their association with man, the Red Junglefowl, the Ring-necked Pheasant and the Indian Peafowl, are not globally at risk, many other species are under pressure directly as a result of man's attentions. While the Red Junglefowl in its domesticated form feeds millions of people throughout the world, many other pheasants and partridges are hunted for food in the wild.

In the past, hunting probably created few problems in terms of the long-term survival of species, as human numbers were small and there were large tracts of wilderness, including forests, wet grasslands and the like. With increasing human populations, shrinking wild areas with ever better access for hunters, as well as new, improved methods for obtaining food,

The chicks of the Palawan Peacock-pheasant are cared for by the female and are regularly brooded while they are small. Chicks often take shelter beneath the female's wing, so that only their heads stick out. It is also common for chicks of peacock-pheasants to take shelter under the female's tail, even on their first day.

[*Polyplectron emphanum*,
Photo: Josep del
Hoyo/Lynx]



such as shotguns and nylon snares, some species appear to have suffered considerably. For example, during his travels, C. Cordier found that the Congo Peafowl had disappeared within a radius of up to 25 kilometres from each village, track and road in the equatorial forest of Zaire.

Countries in which the hunting of ground-dwelling birds poses problems include Thailand and China. In Thailand, trapping for food has been considered one of the most serious threats for most of the phasianids in the country, such as the Long-billed Partridge (*Rhizothera longirostris*), the Chestnut-headed Hill-partridge (*Arborophila cambodiana*), Humes's Pheasant (*Symaticus humiae*) and the Great Argus. An additional problem in Thailand is that many of these species are eagerly sought after by those collecting for the bird trade.

In China, all phasianids, except the Ring-necked Pheasant, are protected by law, either as a "First Class Protected Species", the taking from the wild of which requires a permit from the central Ministry of Forestry in Beijing, or as a "Second Class Protected Species", for which a hunter requires a permit from a provincial forest department. Despite this, illegal hunting does take place, especially in remote regions, of species such as the Himalayan Snowcock and the Daurian Partridge (*Perdix dauurica*). Both of these species are considered safe from extinction at present, but the scale of exploitation is sufficient to have caused declines in some areas. The demand for traditional medicines derived from the Himalayan Snowcock, which are believed to ease rheumatic pains and a variety of other ailments, is a cause for concern. In the eastern Tien Shan Mountains, the local Kazakh hunters have traditionally been careful to take birds on a sustainable basis. But an increase in the demand for the medicines has resulted in outsiders coming into the region, and, lured by the high prices offered for the birds, they will take them at any time of the year. Indiscriminate killing of breeding birds can only have one consequence for the population, and, if local extinction is to be avoided, this unsustainable activity must be controlled.

Across the family as a whole, however, direct overexploitation of this sort poses nowhere near the same degree of threat as does habitat loss. Whether it be the clear-felling of forest for timber, the conversion of forests or grasslands to agricultural land, the drive to "reclaim" land to satisfy the need for ever-

expanding urban centres, or any other form of habitat disruption and modification, loss of habitat is the major problem facing the Phasianidae. In the wet grasslands of the *terai* belt which stretches along the Indo-Nepal border and eastwards into Assam, the Swamp Francolin is steadily losing habitat to agricultural land. In the west of its range, the marshes, and the damp reedbeds associated with them, are drained to make the land suitable for plantations of sugar cane, an important cash crop in much of the western part of this belt. In the east, it is pulses and wheat which are sown in the areas of drained land. Road building also accounts for much swamp land.

The loss of forest in the front ranges of the Himalayas and also in the tropics has, in both cases, been on a scale that has caused concern for some time. The deterioration of Nepal's forests shows no sign of lessening, with loss of forest cover caused by the extraction of branches for fuel, the lopping of oaks to provide animal fodder, and widespread grazing by domestic stock in the forest understorey. In 1979, it was estimated that as much as 60% of the country's forested land had less than 40% tree cover. Forest Galliformes in Nepal include the Satyr Tragopan, the Koklass Pheasant and the Himalayan Monal, the first of which is a threatened species, whilst the second two are not considered threatened perhaps simply because of their large ranges. Nonetheless, the rate of habitat loss, and the deterioration caused by overgrazing of the many large flocks of sheep and goats, are major worries, as they operate throughout much of the front ranges. Bhutan, in the eastern Himalaya, is the single known exception, where forest cover is still extensive and a source of national pride.

The plight of China's forest Galliformes is highlighted by the Brown Eared-pheasant, an inhabitant of montane broad-leaved and coniferous forests in north-east China. Occurring mainly in the Luliang Mountains, but also in the Dongling Mountains and on Xiaowutai Mountain, it is now split up into many small populations. The forests in which the species lives have been heavily exploited, presumably because of their proximity to Beijing, which has long been China's capital. The creation of four reserves specifically designed to protect the habitat of this species may have saved it in the short term, but the complete isolation of such small populations may have serious long-term consequences for the viability of the species.



Immediately after hatching, the nidifugous chicks of the Himalayan Monal are able to move about and to feed themselves, as is the case of other phasianids. Having performed the entire business of incubation alone, the female now accompanies her brood, normally of 3-5 chicks, to suitable places where they can find food, especially insects, as these make up the greater part of their diet in the first weeks of life. Should danger approach, the female begins to make loud, whistling alarm calls, sometimes for several minutes, while the chicks remain hidden.

[*Lophophorus impejanus*, Sagarmatha National Park, Nepal.
Photo: Joanna Van Gruisen/Ardea]

The Copper Pheasant is one of the gamebirds that is most avidly hunted in Japan. In the past, as many as almost 1,000,000 birds of either sex were shot every year. Such overhunting caused a serious decline in this species, which, in turn, led to the shooting of females being banned in 1976.

[*Symaticus soemmerringii* scintillans.
Photo: Jean Howman]

Nowhere has the destruction of forests in recent times been more complete and systematic than in the tropics. The loss of rain forest, particularly in the Sunda Subregion of south-east Asia, from Peninsular Thailand to Borneo and Java, is the result of the highly intensive extraction of timber. Although the Crested Wood-partridge is not the most seriously threatened of the species inhabiting the lowland forest of this subregion, its plight illustrates well that facing all the lowland forest Galliformes of south-east Asia. The species was continuously distributed throughout lowland rain forest from the Isthmus of Kra south through the Malay Peninsula to Sumatra and Borneo at the time that H. Robinson, C. B. Kloss and the other early twentieth century naturalists made their collections and inventories. Today, however, loss of habitat is so widespread that the Crested Wood-partridge may be endangered in Peninsular Thailand. Whilst it may still be common in Indonesia, the paucity of recent records is sufficient for its status to have been considered indeterminate in the country recently, and indeed, there are no breeding records at all for Sumatra; it may have become extinct on the islands of Bangka and Belitung, off Sumatra. In Peninsular Malaysia, it was reported as still common in the early 1980's, at the time when it was predicted that all forest below the hillfoot boundary would be logged by 1990! Thus, it seems that it may well be confined to protected areas within its range in the not too distant future, a gloomy prospect which faces almost all lowland forest specialists.

The open country species of the Western Palearctic and Africa are, by and large, not subject to the pressures that their relatives further east face. This is partly because their habitat requirements do not appear to be as narrow as those of their forest-dwelling relatives, for they can occupy a range of open habitats, such as savanna, scrub and lightly wooded grasslands, or, in other cases, arid scrub, desert or boulder-strewn wadis. Although many of these species have wide distributions, there are some instances where habitat modification has been so extensive that populations are under threat. For example, the Grey Partridge, a species with which man has had a close association (see Relationship with Man) is declining throughout much of its range, as a result of the intensification of agriculture that has taken place in Europe this century. Since the 1940's numbers of birds have declined markedly in many areas, perhaps even in all 31 countries in which the species is found (including introductions). Many agricultural areas have become so intensively farmed that an increasing portion of the original range is becoming uninhabitable for the partridge. In this case, the evidence points to the cause being intensification, such as increasing use of pesticides to boost cereal crop yields. The pesticides reduce the amount of insect life available in field margins to a level at which it can not support many chicks at all during this crucial stage in their lives. Thus, although the Grey Partridge is still considered safe from extinction, it is clear that in many areas it is struggling to survive, and that attempts to understand the problems on a global scale and halt the decline, should continue.

The numbers of most species in the family are currently declining, but some species are much closer to extinction than others, and it is clearly these species that require the most urgent attention. For one, possibly two, species, it is already too late, and another may be on the brink of extinction.

One quail is known to have become extinct through man's activities, and a second may well have gone the same way. The New Zealand Quail was last recorded in 1875, although nobody really knows the reasons for its decline and extinction; two of the most likely causes are disease, brought in by introduced birds, and predation by introduced mammals, such as stoats. From the front ranges of the central Himalayas in India, the Himalayan Quail is known only from nine specimens collected during a few years over a century ago. Taken from the slopes above the hill stations of Mussoorie and Naini Tal in Uttar Pradesh, there have been no confirmed reports since 1876. Although it is often considered extinct, all authors have appeared reluctant to consign it to history, holding out some hope that it may still survive. There are some causes for optimism, such as several unsubstantiated reports during the second half



of the present century, although the reliability of the information is uncertain.

Edwards's Pheasant poses a distinct problem for conservationists, not only because of the urgent need for conservation action, but also because in discussing this form, taxonomists and conservationists are regularly talking at cross purposes. The recently found form *hainhensis*, the Vietnamese or Vo Quy's Pheasant, has been accepted as a full species by some authors, although the limited information available indicates that it is probably better considered a race of Edwards's Pheasant. Each form has been assigned a Mace-Landé threat category, Edwards's Pheasant considered critically threatened, with the increasing possibility that it is, in fact, extinct, and the Vietnamese Pheasant believed to be critical. Several surveys by a team from BirdLife International and the Hanoi University Forest Bird Working Group since the late 1980's have failed to find Edwards's Pheasant in its historical range, where it is only known from a few localities. The Vietnamese Pheasant, in contrast, was confirmed to survive, although habitat loss and trapping for food are serious threats. Whether these two forms are, in fact, one species or two, it is clear that the Vietnamese members of *Lophura*, also including the Imperial Pheasant, are in real trouble.

The Bornean Peacock-pheasant is one of the most enigmatic Galliformes in Asia. Described in 1877 by Brüggeman, and named in honour of Herr Schleiermacher of the Grand Duke's Hessian Museum in Darmstadt, Germany, it was frequently the cause of much activity throughout Borneo by those keen to procure specimens or add the birds to their captive collections. Despite many searches, only a handful of specimens are known in museums and very few birds have reached Western collections. Today there is no clear picture of the range or habitat requirements of the species, as an incomplete record of collecting localities is all the information that exists well over a century after its discovery.

The few confirmed localities are very patchily spread in the east and south of the island, although unconfirmed reports suggest that the species may occur throughout Borneo. What is intriguing, however, is the number of searches, both specifically for this bird previously, and recent, more general avifaunal surveys that have failed to find any evidence of its existence. The rate at which forest continues to be felled on the island is extremely worrying, given the complete lack of any positive information regarding the species. Forest loss is especially severe along the major river systems, and there is a chance that these lowland forests are the main habitat of the Bornean Peacock-pheasant, as in the case of the closely related Malaysian Peacock-pheasant across the South China Sea.

The only perdicine, other than the Himalayan Quail, which may be critically threatened under the Mace-Landé criteria, is



Not all of man's alterations to natural habitats are detrimental to all phasianids. Philby's Partridge, for example, a species essentially of barren rocky hillsides in the mountains of south-western Arabia, often frequents areas of highland cultivation, and the seeds and shoots of cultivated cereals now make up a significant part of its diet. The uniform black face and throat distinguish this species from all other *Alectoris* partridges.

[*Alectoris philbyi*, Saudi Arabia.
Photo: Xavier Eichaker/Bios]

the Sichuan Hill-partridge. Endemic to the subtropical ever-green forest of southern China, it is restricted to an area which may be as small as 1000 square kilometres, while the extent of suitable habitat within this area is possibly much less. Probably always fairly limited in distribution, the species is now threatened by loss of habitat on two fronts, conversion of some forests to forestry farms, and road building leading to increased human incursions. The forestry farm activities involve clearing primary forest and replanting with a mixture of two fir species, one native to south-west China, the other not. The Sichuan Hill-partridge may still survive in the plantations that replace the natural forest, but whether the densely planted firs can support a sustainable population in the long term is another issue entirely. It is still reported to be common in forest on hillsides that are not close to the roadheads. These forests are largely untouched and the lack of roads is the best protection that the species has. Current research efforts are designed to understand the distribution of the partridge and its use of habitat in man-affected areas.

Percidine species that are considered endangered are the Djibouti Francolin (*Francolinus ochropectus*), the Manipur Bush-Quail (*Perdica manipurensis*), and the Orange-necked, Collared Hainan and Annam Hill-partridges. Subspecies considered in need of separate attention that fall into this category are the isolated Moroccan race *ayasha* of the widespread Double-spurred Francolin, and all three races of the Chestnut-necklaced Hill-partridge, although the validity of the Sumatran race *atjenensis* is doubtful.

The future of the Djibouti Francolin, endemic to an area of less than 100 square kilometres in the Horn of Africa was fully revealed in the mid-1980's, when G. and H. Welch undertook an expedition to the species' remaining habitat. They considered that slow, natural dessication of the habitat might be exacerbated by human interference to the point that this francolin might not survive into the next century. About 3500 hectares of suitable juniper forest is estimated to exist in two patches within the Forêt du Day National Park. Continuing civil unrest currently prevents any conservation initiative, action which is necessary to save the species from extinction.

Of equal concern are those species for which it is not possible to assign a threat category because of the lack of

information, and especially worrying is the plight of the Grey-striped Francolin from war-torn Angola in south-west Africa. This species is known to have been hunted, at any rate in the past, and perhaps also at present, and it may survive only in a few hectares of forest. Nahan's Francolin and Schlegel's Francolin (*Francolinus schlegelii*) are similarly little known, as are Verreaux's Monal-partridge (*Tetraophasis obscurus*), Szechenyi's Monal-partridge (*Tetraophasis szechenyii*) and the See-see Partridge. The last three have large distributions in areas that are not heavily populated by humans and in terrain that is not attractive for



The discovery of the Congo Peafowl caused a major stir in the ornithological world in the 1930's. The fact that it was placed in a new genus was important, but even more significant was the very existence of a pheasant in Africa, since all the other pheasants are restricted to Asia, barely reaching the extreme eastern fringe of Europe. The current status in the wild of the Congo Peafowl is virtually unknown, and there have been no records at all since 1982. Birds are kept in captivity in several collections, but the species is apparently rather difficult to breed.

[*Afropavo congensis*.
Photo: Kenneth W. Fink]

The race *hatinhensis* of Edwards's Pheasant was described as recently as 1975, and was classed as a full species. From the first it has been seriously threatened, mainly due to destruction of its habitat. The nominate race seems to be even worse off, and may now be extinct in the wild. The white central tail feathers are diagnostic of *hatinhensis*.

[*Lophura edwardsi*
hatinhensis.

Photo: R. Seitre/Bios]



agricultural or other uses, and, therefore, are probably not threatened to any great degree.

Among the pheasants, endangered or potentially endangered species are Sclater's Monal (*Lophophorus sclateri*) from the eastern end of the Himalayas; the Imperial Pheasant, the third seriously threatened *Lophura* form from Vietnam; the Brown Eared-pheasant and Reeves's Pheasant from northern China; and the Palawan Peacock-pheasant from the Philippines.

Both of the endangered Chinese pheasants, the Brown Eared-pheasant and Reeves's Pheasant, are receiving conservation attention from Chinese ornithologists and officials. Two reserves have been created specifically for each of these species, Panquanggou and Xiaowutai National Nature Reserves in Shaanxi Province for the Brown Eared-pheasant, and Dong Zhai Nature Reserve in Henan, and Tuoda Forest Nature Reserve in Guizhou for Reeves's. The last of these was notified in May 1992, as a result of the study by Wu Zhi-kang, who identified the area and its potential for protection.

The Green Peafowl is also in trouble, whether considered as a whole, or if each of its three subspecies is treated sep-

arately. Once widespread from north-east India and China south to Java, it has been eliminated from most of its range, partly through habitat destruction, but also because it was commonly shot by hunters until it was on the verge of extinction in many areas. The species became extinct in Peninsular Malaysia some time between 1960 and 1965, and there is no recent information from north-east India and Burma west of the River Irrawaddy where the race *spicifer* occurs. Several sites for the species have been reported from southern China, but the alleged occurrence in Tibet needs confirmation. Further south, only one site in Thailand has been confirmed, the Hua Kha Kaeng Wildlife Sanctuary, close to the Burmese border, which is the most extensive tract of unspoilt, prime riverine habitat in the country; it has been proposed as a World Heritage Site. Few localities are confirmed in Vietnam. Again, although nearly 20 sites were discovered during a recent survey on Java, many are very small and the populations within the national parks at each end of the island, Ujung Kulon in the west and Baluran in the east, are likely to remain most important for the species.

Many more pheasant subspecies have been considered worthy of separate treatment in conservation terms than have those of partridges, quails, francolins and snowcocks. This may be partly because they are, relatively speaking, better known, and distributions and taxonomic limits are, in general, somewhat more clearly defined. Subspecies classified as endangered include the nominate race of Blyth's Tragopan, while its eastern race, occurring in Bhutan, is regarded as insufficiently known; also, the geographically isolated races *annamensis*, *engelbachi* and *whiteheadi* of the Silver Pheasant, and the race *nigrescens* of the Crested Argus from the Malay Peninsula, which is restricted to several mountain tops in the Taman Negara National Park.

Whilst the recent Conservation Assessment represents the first time that each species has been considered systematically and the scale of threat facing it assessed, much work towards the conservation of this family had already been undertaken over the last 20 years, and this provided a good deal of the information used to determine status and assign threat ca-

Although the beautiful Palawan Peacock-pheasant is classified as Vulnerable according to the traditional IUCN criteria, application of the more recent Mace-Lande threat categories has led to its listing as Endangered. Endemic to the island of Palawan, its alarming situation seems to be the result of factors similar to those that affect most of the threatened species in the family: deforestation, which is particularly severe in the flat lowlands of Palawan; and hunting, both for food and for the bird trade. Undoubtedly the most emblematic of the island's endemics, this species could be an excellent flagship in conservation campaigns aimed at increasing public awareness.

[*Polyplectron emphanum*,
Palawan, Philippines.
Photo: Günter Ziesler]





The Brown Eared-pheasant is another of the many threatened species in this family. Endemic to the north-east of China, it suffered a major decline historically, due to the widespread deforestation of the mountains within its range. Nowadays, the species is only known to survive at six sites, which are totally isolated from each other. On the positive side, four of these small populations are in protected areas, and censuses carried out in 1989 in two of them, Luyashan and Pangquangou Nature Reserves, were heartening, giving figures of 2790 and 1230 birds respectively, significantly higher totals than estimates made in the early 1980's.

[*Crossoptilon mantchuricum*.
Photo: David Tipling/
Windrush]

tegies. A major stimulus for many surveys and other initiatives has been the World Pheasant Association (WPA). Founded in 1975 to promote the conservation of the world's Galliformes, and thus taking in the grouse, turkeys, cracids, guineafowl and megapodes, much of WPA's early attention was directed towards pheasants and, to some degree, aviculture, as a means of promoting their survival.

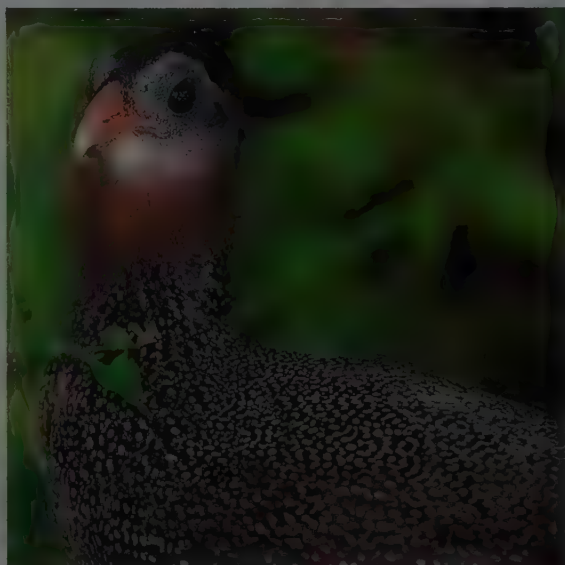
Major conservation initiatives undertaken during that period include detailed survey work on two species then considered to be among the most threatened, the Cheer Pheasant and the Western Tragopan. Both occur in the western Himalayas, the Cheer on mid-altitude grassy slopes with scattered rocky outcrops, interspersed with pine trees and gullies, and the tragopan restricted to moist temperate forest. Results obtained during the Himachal Wildlife Project (see Movements) led to the valleys to the south-east of Kulu being proposed as the site for the Great Himalayan National Park.

Subsequent conservation efforts have taken the form of the ambitious Himalayan Jungle Project, led by BirdLife International, which has the objective of conserving an extensive tract of pristine forest in the Palas Valley in Pakistan through encouraging local people to engage in sustainable use of the forest that will ensure them long-term benefits, whilst permitting this unique area to survive along with its avifauna, of which the Western Tragopan is one spectacular example.

The Cheer was viewed with concern because it seemed to be widely scattered in tiny populations in habitats severely affected by man. Extensive surveys through much of the 1980's, carried out primarily by L. Young, R. Kaul, V. Sharma and S. Pandey, revealed that the species seems to thrive in early succession vegetation that is regularly grazed, cut for hay or burned. Indeed, the protection given to the Margalla Hills National Park near Islamabad in Pakistan led, over a decade or so, to the growth of scrub cover that is now too dense to be considered suitable habitat for the Cheer. The small size of the populations discovered around this time also seems to be natural and no great problem. Many sites were found where only a few pairs could be heard in chorus at dawn and dusk.

This species is also the only one in the family which has been the subject of a concerted reintroduction attempt, started

in the Margalla Hills, within sight of Islamabad. Birds were reared in Pakistan, from eggs laid by some of the large number of captive birds in Europe, and were subsequently released. Radio-tracking has shown that released birds can survive in the wild for as much as 18 months. However, despite about 15 years of effort, there is no evidence of a self-sustaining wild population being established and such a prospect seems so unlikely that the resources expended are being wound down; part of the problem may be the continually expanding city limits of Pakistan's capital. Later, when the first surveys of Cheer populations were conducted across the border in the Indian state of Himachal Pradesh, it was found that most Cheer Pheasants occurred at altitudes above the release site at Margalla. The lessons learned from this attempt are enormously valuable, though, and highlight the many difficulties of this course of action. The project has resulted in the formation of a conservation society in the Margalla Hills National Park,



Both races of the Crested Argus are considered to be threatened. The situation of the nominate, though, seems less worrying than was thought some time ago, as it has been found still to be locally common at several sites in Vietnam, and it occurs further south, and at higher altitudes than was previously thought. In addition, in 1994 it was found to be apparently common at a site in Laos where it was previously known only from some very old records.

[*Rheinardia ocellata ocellata*.
Photo: R. Seitre/Bios]

The Chinese Monal has traditionally been considered a threatened species, due to hunting pressure and habitat degradation caused by overgrazing in its rather restricted range. A recent study by Chinese ornithologists recorded the species at a minimum of 25 locations, seven of which are in protected areas, although the same study seems to confirm that the population is declining slightly. The species was practically unknown in captivity until the 1980's, but a captive breeding programme is now under way at Beijing Zoo, China, and San Diego Zoo, USA, and has borne its first successes. This species is easily distinguished from the other monals by the male's rich coppery mantle and the dark blue-green tail.

[*Lophophorus lhuysii*.
Photo: Kenneth W. Fink]



which will promote public awareness of the value of natural wildlife resources.

Reintroduction will, however, probably remain one of the last courses of action to be taken, because of the resources needed and the sort of detail on the species' ecological and behavioural requirements that are necessary to ensure that the reintroduction attempt stands any chance of success. Studies conducted on the Grey Partridge in southern England have shown that the behavioural development of birds raised in the absence of their mothers is quite seriously impaired and leaves them far more susceptible to predation.

In the years since then, WPA has broadened its horizons so that it now attempts to foster initiatives of any sort that will benefit Galliformes. The challenge is now defined for the Phasianidae and involves a number of urgent conservation issues. These include continued work towards identifying a suitable site for the long-term protection of the Sichuan Hill-partridge, and assessing its management needs in areas where commercial forestry is practised. Other applied questions that need addressing include the proposal of recommendations for managing Swamp Francolin habitat. At the other end of the scale are the Galliformes of Indonesia's protected areas. Current knowledge of their distribution, not to mention any aspect of ecology, is so poor that there is no clear idea of the extent to which existing protected areas will conserve large populations. Consequently, baseline surveys of the protected areas of Borneo and Sumatra are crucial first steps towards assessing the prospects of the species in question. Such measures are similarly required for most other birds on the two islands that are habitat specialists, suggesting that broad avifaunal surveys may be of greater value than searches for individual species or groups of species. In Africa, the dearth of information that exists on the forest Galliformes of southern Uganda should be remedied as soon as possible. Obviously, civil unrest in Angola and Djibouti rules out efforts in those two countries for the time being.

Other priorities for pheasants include further work on the Western Tragopan in the Palas Valley, which will benefit forest management there and elsewhere, and other management-related studies in China. Some of China's reserves which hold pheasants are quite small for these relatively large birds. Therefore, information is required to help guide the

management policies of these areas. China also holds some of the ornithologically least known areas in the world. Especially important is the area where Burma, China and India meet at the eastern end of the Himalayas. In addition to its several Endemic Bird Areas, this is one of the richest spots for Galliformes in the world, and also one of the least known. Surveys in eastern Tibet, south-western Sichuan and north-western Yunnan would help to produce a clearer picture of the current status of this region's birds, several of which are regional endemics.

There are many challenges ahead in the struggle to guarantee the survival of the world's pheasants, partridges, quails, francolins and snowcocks. However, the scale of the task has now been outlined, and a start has been made to address some of the major concerns.

General Bibliography

- Aebischer (1991), Assink (1993a, 1993b), Beebe (1914a, 1914b, 1918-1922, 1936), Beer (1990), Birkan, Potts *et al.* (1992), van Bockstaele (1993a, 1993b), Bradshaw (1992), Brodkorb (1964), Carroll (1990), Cheng Tso-hin (1990), Cooper (1990), Cooper & Hillgarth (1990), Cracraft (1981), Crowe *et al.* (1992), Davison (1976, 1980a, 1985b, 1986a, 1986b, 1988), Delacour (1977, 1978), Delacour & Ridley (1985), Eames & Rands (1993), Elliot (1870-1872), Garson (1990), Garson & McGowan (1994), Gaston (1987a), Gutiérrez *et al.* (1983), Guyomarc'h & Guyomarc'h (1981), Hanotte *et al.* (1992), Helm-Bychowski & Wilson (1986), Hewitt (1992), Hill *et al.* (1990), Hillgarth (1990, 1992), Hillgarth & Dawkins (1992), Howman (1993), Hudson & Rands (1988), Jenkins (1993), Johnsgard (1983b, 1986a, 1986b, 1988), Kruijt (1962a, 1962b), Kuroda (1970), Maru (1980), McGowan, Carroll & Ellis-Joseph (1994), McGowan, Dowell *et al.* (1994), Ogilvie-Grant (1896-1897), Olney (1990), Pandey (1993b), Perrins (1992), Peters (1934), Potts (1987), Raethel (1988), Randi *et al.* (1991), Rands (1985, 1986, 1992), Ridley (1981, 1983, 1986a, 1986b, 1987), Robbins (1981, 1984, 1992), Robertson & Dowell (1990), Rutgers & Norris (1970), Savage (1980), Savage & Ridley (1987), Sibley & Ahlquist (1990), Sibley & Monroe (1990), Sibley *et al.* (1988), Sigursjónsdóttir (1981), Stock & Bunch (1982), Stokes & Williams (1971, 1972), Sych (1990), Sych & Bogdanovich (1988), Tapper (1992), Verheyen (1956), Wayre (1969), Young & Hussain (1990), Zheng Guang-mei (1988).



PLATE 42

inches 8
cm 20

Subfamily PERDICINAE

Genus *LERWA* Hodgson, 1837

1. Snow Partridge

Lerwa lerwa

French: Lerva des neiges

German: Haldenhuhn

Spanish: Perdiz Lerwa

Taxonomy. *Perdix Lerwa* Hodgson, 1833, northern Nepal.

Eastern population has been separated in different subspecies, *major*, though doubtfully distinct. Monotypic.

Distribution. Himalayas from E Afghanistan through S & E Tibet to Assam and C China (S Gansu, NW Sichuan and N Yunnan).



Descriptive notes. 37-40 cm; 454-709 g. More barred dorsally than other Himalayan Galliformes; bright red bill and feet. Female almost identical, but slightly smaller than male; lacks spur and differs in intensity of bill colour, especially during breeding season. Immature less strikingly marked than adult, with broader barring on upperparts and head.

Habitat. Alpine meadows and open, rocky hillsides above tree-line with scattered rhododendron bushes and grasses, ferns and lichens, and also with snow patches. Usually between 3000 m and 5000 m, up to limit of permanent snow; rarely below 2500 m. In SW China found in all alpine habitats present: exposed rock with some lichens and sparse grass, and herb cover, including *Saussurea medusa*, *S. laniceps* and *Mecanopsis punica*; meadows, where flat terrain more densely covered by herbs and grasses, e.g. *Festuca ovina* and *Anaphalis longifolium*; and amongst shrubby grassland, where various *Salix* species and *Holcystrochiton tibeticum* can be found. Spring records evenly spread between these habitats.

Food and Feeding. Lichen, moss and other plant matter predominates. Seeds, flowers, leaves and shoots of 43 plant species recorded in SW China; grasses important, with most parts of several *Agrostis*, *Festuca* and *Polygonum* species taken, as well as herbs, e.g. gentians and *Potentilla*; also small amount of animal food. Forages in pairs or small groups.

Breeding. Lays from late May to mid-Jun in SW China. Monogamous and territorial. Nest is a hollow by cliffs or among alpine shrubs. Completed clutches of 2, 3 and 5 eggs recorded; incubation by female alone; in captivity, young reach adult weight at c. 100 days. Young birds stay with parents until following breeding season, and some still seen on territories as subadults; groups of up to 30 birds seen together later in year.

Movements. May descend in severe winters to 2100-2700 m from usual altitudes above 3000 m. In China remains above 3800 m; no altitudinal migration noted in Longmen Mts, SW China.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Was thought to be rare in China, but probably a consequence of its remote habitat being rarely visited and species remaining little known. Occupies sizeable range, with estimate of at least 100,000 km² of suitable habitat available; where present, generally considered to be common. This may suggest total population in order of hundreds of thousands; believed to be declining slightly. Threatened by habitat degradation and overexploitation; in Longmen Mts (SW China), human encroachment is considerable problem, with attendant poaching and herb collection disturbing nesting birds; species thought to have declined in W Himalayas, as palatability and tameness make it attractive target for hunters; in Pakistan now rare and local. Unlikely to be threatened in Bhutan. Whilst there is no need for immediate action, wildlife protection throughout species' range should be improved in order to halt decline in numbers. Known from three protected areas, Zayu Natural Reserve in Tibet, and Fengtongzai and Xiaozhaizigou Natural Reserves in Sichuan; probably occurs in others.

Bibliography. Ali (1962), Ali & Ripley (1980), Cheng Tso-hin (1987), Cheng Tso-hin *et al.* (1978), Deng Wei-je (1990), Etchécopar & Hue (1978), Gaston *et al.* (1993), He Fen-qi & Cui Xie-zhen (1990), Inskipp & Inskipp (1985, 1986, 1993b), Li Xiang-tao & Lu Xiao-yi (1992), Ludlow & Kinnear (1944), Meinertzhagen (1927), Meyer de Schauensee (1984), Roberts (1991), Whitehead (1914).



Female similar to male but has outer webs of secondaries and secondary coverts mottled buff; lacks spurs.

Habitat. Upper coniferous forest, rhododendron scrub and alpine meadows between 3000 m and 4100 m; exposed rocky mountain slopes.

Food and Feeding. No information available.

Breeding. No reliable information available.

Movements. No information available.

Status and Conservation. Not globally threatened. Mace-Lande: Insufficient information. Currently considered near-threatened. Legally protected species in China; was

thought uncommon, but probably a consequence of its remote habitat being rarely visited and the species remaining little known. Very little information available other than that species is now considered to be quite common although declining slightly. Habitat degradation is a threat and before other actions can be proposed, a baseline survey is needed to assess distribution and abundance.

Bibliography. Cheng Tso-hin (1987), Cheng Tso-hin *et al.* (1978), Deng Wei-je (1990), Etchécopar & Hue (1978), He Fen-qi & Cui Xie-zhen (1990), Meise *et al.* (1938), Meyer de Schauensee (1984), Raethel (1988), Schönwetter (1967), Shi Dong-chou (1986).

3. Szechenyi's Monal-partridge

Tetraophasis szechenyii

French: Tétraphase de Szecheny

German: Rostkehl-Keilschwanzhuhn

Spanish: Perdiz-faisán Gorgiclara

Other common names: Buff-throated/Tibetan Monal-partridge/Partridge, Szechenyi's Pheasant-grouse/Pheasant-partridge/Partridge

Taxonomy. *Tetraophasis Szechenyii* Madarász, 1885, Sichuan or east Tibet.

Sometimes considered race of *T. obscurus*, with which forms superspecies. Monotypic

Distribution. E Himalayas, from extreme NE India and E Tibet to SC China (Sichuan and Yunnan).



Descriptive notes. c. 50 cm; two males 1020 g and 1500 g, one female 880 g. Present species and *T. obscurus* are amongst the most pheasant-like perdicines, with long tails that can be partially erected and spread when the birds are alarmed. Differs from *T. obscurus* by having chin, throat and foreneck pale fawn, rather than dark chestnut; has greyer rump and uppertail-coverts, and chestnut spots on underparts. Female similar to male, but slightly smaller and lacks spurs. Juvenile heavily barred black and brown on upperparts.

Habitat. Fir forest, rhododendron scrub and rocky gullies with cover in alpine zone; most-

ly in forest, but also occurs above tree-line in rocky alpine zone. Between 3300 m and 4600 m.

Food and Feeding. Small roots, small bulbs and green leaves.

Breeding. Only information available is that chicks were seen in Tibet from late May to Aug. and family groups of 6-12 noted.

Movements. No information on possible altitudinal migration. When flushed, flies downhill to cover.

Status and Conservation. Not globally threatened. Mace-Lande: Insufficient information. Currently considered near-threatened. Legally protected species in China was thought uncommon, but probably a consequence of its remote habitat being rarely visited and the species remaining little known. Apparently widely distributed in Qinghai, Xizang (Tibet), Sichuan and Yunnan, but distribution within known range may be very fragmented. Common in E Tibet; no information at all from NE India, which lies on edge of range. In past, assumed to be under some pressure from humans, such pressure might exist, but has not yet been identified. Baseline survey needed to assess distribution and propose future actions, if needed.

Bibliography. Ali & Ripley (1980), Cheng Tso-hin (1987), Cheng Tso-hin *et al.* (1978), Etchécopar & Hue (1978), Harten (1912-1922), He Fen-qi *et al.* (1990), Ludlow & Kinnear (1944), Meyer de Schauensee (1984), Raethel (1988), Robson (1986), Schäfer (1934), Schönwetter (1967), Vaurie (1965d)

Genus *TETRAOPHASIS* Elliot, 1871

2. Verreaux's Monal-partridge

Tetraophasis obscurus

French: Tétraphase de Verreaux

Spanish: Perdiz-faisán Gorgioscura

German: Braunkehl-Keilschwanzhuhn

Other common names: Chestnut-throated Monal-partridge/Partridge, Verreaux's Pheasant-grouse/Pheasant-partridge/Partridge

Taxonomy. *Lophophorus obscurus* J. Verreaux, 1869, east Tibet = Mupin, Sichuan.

Sometimes considered conspecific with *T. szechenyii*, with which forms superspecies. Monotypic.

Distribution. W China, in NE Tibet, Qinghai, Gansu and Sichuan.

Descriptive notes. c. 47 cm; one male 938 g, two females 720 g and 840 g. Present species and *T. szechenyii* are amongst the most pheasant-like perdicines, with long tails that can be partially erected and spread when the birds are alarmed. Separated from *T. szechenyii* by having chin, throat and foreneck mainly dark chestnut, rather than pale fawn; has browner rump and uppertail-coverts.

Genus *TETRAOGALLUS* J. E. Gray, 1832

4. Caucasian Snowcock

Tetraogallus caucasicus

French: Tétragalle du Caucase

German: Kaukasuskönigshuhn

Spanish: Perdigallo Caucásiano

Taxonomy. *Tetrao caucasicus* Pallas, 1811, rocky heights of the Caucasus.

Has been included within a species group, the dark bellied snowcocks, with *T. caspius* and *T. himalayensis*. Monotypic.

Distribution. Caucasus, on main ridge and those to N.

Descriptive notes. c. 56 cm, male c. 1930 g, female c. 1730 g; wingspan 80-95 cm. Differs from other snowcocks in dark grey underparts with strong barring and scalloping on breast, nape rusty. Female duller than male, with more white in plumage, lacks spurs. Immature has plumage pattern less clearly marked.



Habitat. Mountain slopes adjacent to forest from 2500 m up to snow-line, in some areas from 1800 m, and mainly below 4000 m. Found on scree and rocky outcrops, but not in forest or scrub; avoids large tracts of snow cover.

Food and Feeding. Predominantly vegetarian, feeding on most plant parts (leaves, fruits, stems, tubers, etc.); nearly 40% of total weight in spring and summer made up by grasses such as *Poa* and *Festuca*; over 40% in remainder of year; 30-35% of species such as *Campanula*, *Alchemilla*, etc. Change in diet through year restricted to parts of plant eaten shoots and similar eaten when available; dry matter in autumn and winter. Young birds consume more legumes. When foraging, birds move up hillside; outwith breeding season usually in groups of 6-8 birds.

Breeding. Laying late Apr to Jul, including re-nests; nesting at upper altitudes up to 15 months later than at lowest altitudes; considerable variation between years in timing of commencement of courtship, but usually from early Apr. Believed to be monogamous. Nests in the open, or under a rock overhang. Lays 5-8 eggs, average 6.5; incubation c. 28 days, by female only; downy chicks are buff-coloured above, densely marked with sepia brown and black, pale cream below. Sexual maturity apparently reached at one year old.

Movements. Said to perform altitudinal migrations; in warm weather, after breeding, moves to higher altitudes, following line of perennial snows.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Included on USSR Red List in 1978. Despite small range, numbers now believed to be stable, in hundreds of thousands. In Azerbaijan is uncommon resident; total of 800-1000 birds (300-400 pairs) estimated in 1993; in 1990, 87 birds counted on Mt Babadag, and 115 in Zakataly Reserve. Only real threat is from habitat degradation caused by overgrazing by domestic stock. In Turkey, species occurs only in Arvin; hunting has been banned. Present in at least three protected areas, the Tebedzinski Reserve in Russia, the Zakataly Reserve in Azerbaijan and the Lagodechy Reserve in Georgia; occurs in Caucasus Endemic Bird Area.

Bibliography. Bannikov (1978), Baziev (1965, 1966, 1968, 1972, 1978), Bianki (1898), Cramp & Simmons (1980), Dementiev & Gladkov (1952), Fjeldså (1977), Flint *et al.* (1984), Hartert (1912-1922), Knystautas (1993), Kozlova (1952), Kuz'mina (1992), Patrikeev (1993), Potapov (1992b), Potapov & Flint (1989).

5. Caspian Snowcock

Tetraogallus caspius

French: Tétragaile de Perse German: Kaspikönigshuhn Spanish: Perdigallo del Caspio

Taxonomy. *Tetrao caspius* S. G. Gmelin, 1784, Astarabad, northern Iran.

Has been included within a species group, the dark-bellied snowcocks, with *T. caucasicus* and *T. himalayensis*. Population of Turkey and Armenia has been separated in different subspecies, *tauricus*, but doubtfully distinct. Two subspecies recognized.

Subspecies and Distribution.

T. c. caspius (S. G. Gmelin, 1784) - S & E Turkey through Armenia and NW Iran to S Transcaspiia. *T. c. semenowianschanskii* Zarudny, 1908 - Zagros Mts, Iran.



Descriptive notes. 55-61 cm; male 2500-2684 g, female 1800-2344 g; wingspan 95-105 cm. Similar to *T. caucasicus*, but appears greyer, and breast thinly spotted rather than barred. Female smaller and duller than male; lacks spurs. Immature has plumage pattern less clearly marked.

Habitat. Mountain slopes, mostly from 2400 m up to snow-line, but in some places down to 1800 m, and up to 4000 m. Found on scree and rocky outcrops, and occasionally down between tree-line and permanent snow areas, even descending among trees in late summer.

Typical habitat consists of steep slopes lacking snow cover, and gorges, crags and similar, with patches of snow and some herb and grass cover.

Food and Feeding. Believed to be vegetarian, with similar diet to *T. caucasicus*.

Breeding. Laying in late Apr and May; courtship usually begins in Apr. Believed to be monogamous. Nests in the open or under a rocky overhang. Normally 5-9 eggs laid; incubation 28-29 days, young hatching synchronously; chicks have cinnamon-pink and dark grey down above, whitish below; young raised by female alone; believed capable of precocial flight at 15-20 days. Sexual maturity apparently reached at one year old.

Movements. Mainly sedentary, but some altitudinal movement recorded in Turkey. In some areas does not descend at all, even in spells of heavy snow.

Status and Conservation. Not globally threatened. Mace-Lande: Vulnerable. CITES I. Included on USSR Red List in 1978. Seems to be poorly known. Based on extent of available habitat and abundance in some areas, total population estimated at 5000-15,000 birds. A more precise estimate of 8400-11,200 birds results from following figures: eleven populations were believed to hold fewer than 850 individuals in the Transcaucasus (Armenia and Azerbaijan) in 1978; 350 birds in Turkmenia in 1986; estimated 200-2000 individuals in Turkey, scattered in high mountains where status is uncertain, but species may be locally numerous; 7000-8000 birds in NW Iran. Pronounced decline in Armenia, Azerbaijan and Turkmenia at least; in Turkmenia, a dramatic population decrease occurred in Kopetdag Mts during late 1980's, attributed to poaching. Occurs in the Kafar and Dilijan Reserves in Armenia, Geygel Reserve in Azerbaijan and Kopetdag Reserve in Turkmenia. Threatened by overgrazing of its alpine habitat, which is easily reached by shepherds with guns, and with their sheep and dogs. In 1993 most of species' range in Azerbaijan was suffering with intensive military activity, and it was feared that poaching and spread of long range fire-arms could have drastic effects. Habitat protection is needed and an extensive survey should aim to locate healthy populations in Iran and Turkey. Species does not adapt well to captivity.

Bibliography. Bannikov (1978), Baziev (1972, 1978), Bianki (1898), Cramp & Simmons (1980), Dementiev & Gladkov (1952), Fjeldså (1977), Flint *et al.* (1984), Hue & Etchécopar (1970), Kiziroglu (1993), Knystautas (1993), Kozlova (1952), Kuz'mina (1992), Patrikeev (1993), Potapov (1992b), Potapov & Flint (1989), Schönwetter (1967), Vauce (1965d).

6. Himalayan Snowcock

Tetraogallus himalayensis

French: Tétragaile de l'Himalaya

German: Himalayakönigshuhn

Spanish: Perdigallo Himalayo

Taxonomy. *Tetraogallus himalayensis* G. R. Gray, 1843, Himalayas.

Has been included within a species group, the dark-bellied snowcocks, with *T. caspius* and *T. caucasicus*. Population of NW Afghanistan has been separated in race *bendi*, although usually included within *incognitus*. Five subspecies recognized.

Subspecies and Distribution.

T. h. sewerzowi Zarudny, 1910 - Tien Shan Mts N to Zaysan (E Kazakhstan) and E to Xinjiang (NW China).

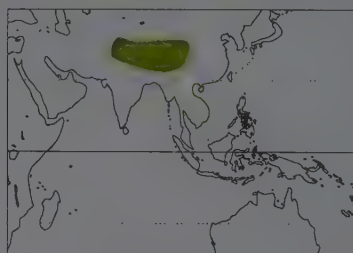
T. h. incognitus Zarudny, 1911 - mountains of S Tajikistan and N Afghanistan.

T. h. himalayensis G. R. Gray, 1843 - E Afghanistan E to Ladakh (NW India) and Nepal.

T. h. grombchewskii Bianchi, 1898 - CW China, in W Kunlun Mts, N Tibet and S Xinjiang.

T. h. koslowi Bianchi, 1898 - WC China, in Nan Shan and Ching Hai Ku Mts of Qinghai and S Gansu.

Introduced successfully to North America (NE Nevada).



Descriptive notes. 54-72 cm; 2000-3629 g. Similar to *T. caspius* but breast paler and with more horizontal blackish streaking. Only member of genus with a thin brown collar at base of white throat. Female slightly smaller than male; lacks spurs; forehead buff, and area around eye is greyer. Immature paler, with less distinct markings, except for white supercilium. Races vary in general tone of plumage coloration, nominate darkest.

Habitat. Open mountain slopes from just below tree-line up to snow-line; steep alpine pastures and rocky ridges. In Pakistan, usually between 3900 m and 4570 m, but occasionally

below 3600 m; found in steep valleys and on mountain spurs at highest altitudes.

Food and Feeding. In Jul-Aug in Hunza, Pakistan, predominantly bulbous roots and tubers, *Ephedra* berries, grasses (*Poa*, *Alopecurus*), sedges, shoots and leaves. In winter takes variety of vegetable material from exposed slopes where snow does not persist, eating similar food to that consumed in summer; seeding grass heads form staple diet. Moves uphill during the day, foraging by raking the ground and digging with bill.

Breeding. Laying late Apr to mid-May; display in mid-Apr in Tien Shan Mts, W China. Monogamous and territorial. Nests amongst grass tufts near rock or boulder. Usually 8 eggs (5-10); incubation 30 days, by female alone; both parents raise young.

Movements. In general, reported to occur at 3600-5100 m in summer, moving down to 2100 m in winter. Where introduced in Nevada, USA, remains above 3000 m throughout winter; in winter, groups of 30-40 birds seen.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Overall status remains unclear. Very widespread with range possibly covering over 1,000,000 km². No detailed data available on numbers, but an informed estimate suggests total of more than 200,000 individuals, with population thought to be stable. Considered plentiful throughout large expanse of mountainous terrain in Pakistan, especially in Hunza, Gilgit and Baltistan; less common in Safed Koh range than some parts of Chitral, and sparse in Swat Kohistan. Scattered throughout ranges of C Afghanistan; rare in inner ranges of Nepal. In some places, overhunted for food. Occurs in the Issyk-Kul Reserve in Kirghizia. As much of distribution is in rugged and unpopulated regions, protected areas may not be essential to species' survival. Introduced population of North America estimated at 250-500 birds.

Bibliography. Ali & Ripley (1980), Bates & Lowther (1952), Baziev (1978), Bianki (1898), Biddulph (1881), Bland (1987), Bland & Temple (1990), Blumstein & López (1993), Cheng Tso-hin (1987), Dementiev & Gladkov (1952), Etchécopar & Hue (1978), Flint *et al.* (1984), Fulton (1904), Gaston *et al.* (1993), Holmes (1986), Huang Ren-xin *et al.* (1990), Inskipp & Inskipp (1985), Kaul & Qadri (1989), Knystautas (1993), Kozlova (1952), Kuz'mina (1992), Lamba *et al.* (1987), Liu Nai-fa *et al.* (1990), Ma Li (1992), Mallon (1987), Marlen (1961), Matthews (1941), Mayers (1984), Paludan (1959), Plumley & Sharma (1990), Potapov (1992b), Potapov & Flint (1989), Roberts (1991), Shen Xiao-zhou & Wang Jia-jun (1963), Stiver (1984).

7. Tibetan Snowcock

Tetraogallus tibetanus

French: Tétragaile du Tibet

German: Tibetkönigshuhn

Spanish: Perdigallo Tibetano

Taxonomy. *Tetraogallus tibetanus* Gould, 1854, Tibet = Ladakh.

Has been included within a species group, the white-bellied snowcocks, with *T. altaicus*. Six races sometimes accepted, but *tshimenensis* included in nominate *tibetanus*, and *centralis* within *przewalskii*. Four subspecies currently recognized.

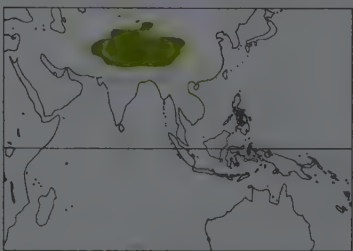
Subspecies and Distribution.

T. t. tibetanus Gould, 1854 - Pamirs and Tajikistan SE to W Tibet and Ladakh.

T. t. przewalskii Bianchi, 1907 - NE India to WC China (Qinghai, SW Gansu and NW Sichuan).

T. t. aquilonifer R. & A. Meinertzhagen, 1926 - W Nepal E to Bhutan.

T. t. henrici Oustalet, 1891 - E Tibet to NW Sichuan.



Descriptive notes. c. 50 cm; male 1500-1750 g, female 1170-1600 g. Separated from other snowcocks by extensive white underparts with heavy blackish streaks on flanks; head pattern also characteristic. Female smaller than male, with less well defined head and neck pattern; lacks spurs. Immature paler; plumage pattern less clearly marked, except for more conspicuous white supercilium. Races separated by colour of head, nape and back; *aquilonifer* darkest.

Habitat. Open slopes from 3700 m up to permanent snow-line. Up to c. 5800 m in W Himalayas in summer, where inhabits alpine pastures and stony ridges with sparse grass covering above tree-line.

Food and Feeding. Almost no specific information, but apparently similar to *T. himalayensis*; grasses and herbs taken include *Stellaria*, *Saxifraga*, *Oxytropis*, *Potentilla* and *Primula*.

Breeding. Season lasts from late May to early Jul (1 record of late Aug). Lays 4-5 eggs (4-7). Broods of 4-6 seen in mid-Jul. No further information available.

Movements. Up to 5800 m in summer months, moving down to 3000-4000 m in winter; apparently sometimes gathers in groups in autumn before descending.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. CITES I. Widely distributed, with range believed to be over 500,000 km²; detailed surveys in some areas indicate species may be fairly common, suggesting total population in hundreds of thousands; considered stable at present but irregular changes in number are reported. Possible threats, if any, have not yet been identified, so their significance for long-term survival of species necessarily remains unknown; no information on whether or not species occurs in any protected areas. Collection of baseline information on status is of prime importance.

Bibliography. Ali (1962), Ali & Ripley (1980), Baker (1930, 1935), Baziev (1978), Bianki (1898), Cheng Tso-hin (1987), Cheng Tso-hin *et al.* (1978), Dementiev & Gladkov (1952), Deng Wei-jie (1990), Eichécopar & Hùe (1978), Flint *et al.* (1984), He Fen-qi & Cui Xie-zhen (1990), Inskipp & Inskipp (1985), King & Peng Ji-tai (1991), Knyshtaus (1993), Kozlova (1952), Kuz'mina (1992), Ludlow & Kinnear (1944), Mallon (1987), Marien (1961), Potapov (1966, 1992b), Potapov & Flint (1989), Robson (1986), Shen Xiao-zhou & Wang Jia-jun (1963), Yang Lan & Xu Yan-gong (1987), Zheng Sheng-wu & Pi Nan-lin (1979).

8. Altai Snowcock

Tetraoallus altaicus

French: Tétragalle de l'Altai **German:** Altaikönigshuhn **Spanish:** Perdigallo Altaico

Taxonomy. *Perdix altaica* Geblér, 1836, Argut River in Katun Mountains, Altai.

Has been included within a species group, the white-bellied snowcocks, with *T. tibetanus*. On occasion, two subspecies have been recognized, but *orientalis*, of NW Mongolia, probably not valid. Monotypic.

Distribution. S Siberia and Mongolia, in Sayan, Tuva and Altai Mts.



Descriptive notes. c. 57 cm; male c. 3000 g, female c. 2540 g. Similar to *T. tibetanus*, but white underparts are not streaked black, and breast spotted black, as opposed to blotched with white. Female smaller than male; lacks spurs. Immature similar to adult, but outer primaries pointed and worn.

Habitat. Steppes, alpine meadows and tundra in mountain ranges, from 400 m up to snow-line.

Food and Feeding. Tubers, bulbs, seeds, shoots (e.g. *Betula*), and berries, including *Berberis*; some insects also eaten.

Breeding. Lays c. mid-Mar, exact date depending upon weather, habitat and age of birds. Nest situated in gravel, and lined with feathers. Five clutches of 4, 6, 8, 8, 15 eggs; incubation 28 days, by female alone. Young breed in following season.

Movements. No altitudinal movement recorded, but on occasions of heavy winter snowfall birds will move horizontally to areas with less snow. Birds move about throughout the mountains.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Overall status remains unclear. Considered a rare and endangered species in USSR in 1978. Although range may amount to over 100,000 km², the naturally fragmented habitat probably covers a much smaller total area; occurs in a non-highlighted Endemic Bird Area. Total population estimated at 50,000-150,000 individuals, with numbers stable, increasing or decreasing, according to locality; apparently stable or declining overall. Main threats are overexploitation and a variety of pressures on habitat, e.g. degradation through overgrazing by domestic stock and conversion to agriculture, leading to increased fragmentation. Believed to be increasingly used in Tibetan medicine. Present in the Altai and Katun Protected Areas.

Bibliography. Bannikov (1978), Bianki (1898), Borodin *et al.* (1985), Dementiev & Gladkov (1952), Eichécopar & Hùe (1978), Flint *et al.* (1984), Fox (1990), Irisov (1991), Knyshtaus (1993), Kozlova (1952), Kuz'mina (1992), Lukianov (1992), Maleshin *et al.* (1981), Potapov (1992b), Potapov & Flint (1989), Rogacheva (1992), Shen Xiao-zhou & Wang Jia-jun (1963), Zong & Bold (1983).



Genus *ALECTORIS* Kaup, 1829

9. Arabian Partridge

Alectoris melanocephala

French: Perdrix à tête noire **German:** Schwarzkopf-Steinhuhn **Spanish:** Perdiz Árabe
Other common names: Arabian Red-legged Partridge

Taxonomy. *Perdix melanocephala* Rüppell, 1835, mountains near Jeddah, Saudi Arabia. Distinctive member of genus, sometimes separated in monotypic subgenus. Population from E Hadramut, Saudi Arabia, has been separated in different race, *quichardi*, but not widely accepted. Monotypic.

Distribution. S Arabia from Jeddah (W Saudi Arabia) S to Aden (Yemen) and E to Muscat (Oman). No acceptable record for Eritrea, where data may be based on released birds.



Descriptive notes. 40-43 cm; male c. 724 g, female c. 522 g. Differs from other *Alectoris* by larger size, grey tail feathers (visible in flight), and black crown. Female slightly smaller than male. First-winter bird similar to adult, but has short crest, blackish bill and possibly duller general appearance.

Habitat. Stony and somewhat better vegetated ground in hills, mountains and upland plains, from near sea-level to 3000 m, including montane juniper forest. In Oman, inhabits mountains, wadis and upland plains where there is vegetation; also visits cultivation.

Food and Feeding. Feeds on vegetable matter, seeds and invertebrates. Crops contained the grass *Schismus barbatus* and the herb *Gnaphalium pulvinatum*, as well as cereal seeds and insects; those from Aden with higher proportions of cultivated grain and about 15% insects. Forages and drinks in morning and evening.

Breeding. Lays late Mar in Arabia; formerly Jul-Aug in Eritrea, where now extinct, and in any case perhaps exotic. Nest usually sited over 600 m above sea-level, under cover. Usually 5-8 eggs (5-11).

Movements. No information available, but presumably sedentary. Escapes potential predators by running uphill.

Status and Conservation. Not globally threatened. Mace-Land: Safe. Locally common in Saudi Arabia with highest densities in juniper forest; widespread but uncommon in Yemen; fairly common in Oman. Numbers assumed to be stable throughout range; recently reported from around Medina, thus extending range considerably. Occurs in Raydah Reserve within Asir National Park, Jebel Firqah Protected Area and several proposed protected areas. Whilst no threats are documented, species likely to be affected by pressures on its habitat, e.g. grazing by domestic stock and conversion to agricultural land, as well as periodical drought in places. Direct exploitation (hunting and collection of eggs) occurs, but not believed to have significant adverse effects at present. Juniper forest may be a key habitat, and areas should be set aside to protect this continually degraded habitat; any conservation initiatives should aim to assess the importance of juniper and propose management and protection measures.

Bibliography. Ash (1992), Gallagher & Woodcock (1980), Hollom *et al.* (1988), Mackworth-Praed & Grant (1957), Meinertzhagen (1949, 1954), Rahmani & Shobrak (1993), Randi, Alkon & Meriggi (1992), Randi, Meriggi *et al.* (1992), Rands *et al.* (1987), Watson, G.E. (1962a).

10. Przevalski's Partridge

Alectoris magna

French: Perdrix de Przevalski **German:** Przevalskisteinhuhn **Spanish:** Perdiz Magna
Other common names: Rusty-necklaced Partridge, Przevalski's Rock-partridge

Taxonomy. *Caccabis magna* Przevalski, 1876, Zaidam, Koko-nor (= Ching Hai Ku Mountains) and northern Tibet.

Formerly included in genus *Caccabis*; *C. hwanghoensis* is a synonym. Forms superspecies with *A. graeca*, *A. chukar* and *A. philbyi*. Has been considered a race of *A. graeca*. Monotypic.

Distribution. NC China (Qinghai and SE Gansu).



Descriptive notes. c. 38 cm; male 445-710 g, female 442-615 g. Pattern of collar unique among members of *Alectoris*: very narrow, mostly rusty brown with inner edge fuscous to black. Similar to *A. chukar* in dorsal colour, but closer to *A. graeca* in patterns of lores and flanks; differs from both in yellowish grey, rather than brown, eyes. Female only slightly smaller than male.

Habitat. Apparently occupies rocky hillsides and valleys covered with grass and small bushes from 1300 m to 4000 m.

Food and Feeding. Adults eat seeds, rhizomes, bulbs, seedlings and shoots; also some insects. Young birds consume mostly insects and green leaves.

Breeding. Lays from early May; pairing from late Mar to mid-Apr. Nests by cover in sunny locations on steep ground, or on cliffs of yellow soil ravines; nest is a simple hollow lined with grass, leaves, etc. Records of 7 clutches with 7-20 eggs, average 12.3; incubation 22-24 days under artificial conditions, by female alone. Both parents tend young, families staying together until next breeding season.

Movements. Altitudinal migration reported to occur in E Qinghai Plateau, but not in Yellow Soil Plateau.

Status and Conservation. Not globally threatened. Mace-Land: Safe. Currently considered near-threatened. In NC China, densities vary from less than 4 birds/km² to over 14 birds/km², depending on habitat type, with yellow soil ravines around farmland and water the most favoured. Total population size likely to be in hundreds of thousands. Species has restricted range; occurs in Qinghai Mts Endemic Bird Area. Hunting is a major problem; species is persecuted throughout range and has been driven to extinction in some areas. A strategy for rational use should be devised to curtail this overexploitation before numbers drop excessively.

Bibliography. Cheng Tso-hin (1987), Cheng Tso-hin *et al.* (1978), Elchécopar & Hue (1978), Liu Nai-fa (1984, 1992), Liu Nai-fa & Yang You-lao (1982), Meyer de Schauensee (1984), Raethel (1988), Randi, Alkon & Meriggi (1992), Watson, G.E. (1962a, 1962b).

11. Rock Partridge

Alectoris graeca

French: Perdrix bartavelle **German:** Steinhuhn **Spanish:** Perdiz Griega

Taxonomy. *Perdix graeca* Meisner, 1804, Greece.

Forms superspecies with *A. magna*, *A. chukar* and *A. philbyi*. Treatment of this species has varied considerably; has been considered to include *A. chukar* and *A. magna* in the past. Possibly hybridizes with *A. chukar* in some areas and with *A. rufa*, which is introduced in parts of France. Three subspecies recognized.

Subspecies and Distribution.

A. g. saxatilis (Bechstein, 1805) - Alps from France to Austria and W Yugoslavia; Apennines.

A. g. graeca (Meisner, 1804) - SE Yugoslavia to Greece and Bulgaria.

A. g. whitakeri Schiebel, 1934 - Sicily.

Indeterminate mixed populations of present species and *A. chukar* introduced into UK, Russia, USA, Canada, Mexico and New Zealand; Hawaiian birds known to derive from *A. chukar*.



Descriptive notes. 33-37 cm; male 550-850 g, female 410-650 g; wingspan 46-53 cm. Difficult to separate in field from *A. chukar*; slight differences in extent of black pattern on head, upper breast and flank feathers; upperparts generally more bluish grey, rather than brownish. Female slightly smaller than male, with duller head pattern and no tarsal knob. Immature smaller and much duller with less extensive patterning. Races separated mainly by tone of plumage coloration and flank pattern.

Habitat. Rocky hills and mountain slopes with calcareous rock, short grass, sparse shrub cover and some tree stands; from sea-level up

to 2400 m, exceptionally to 2700 m in Italy. In subalpine zone, usually above 900 m, commonly between 1200 m and 1500 m. Not normally in forest, but present in open woodlands of *Pinus*, *Larix* and *Juniperus* amongst others; prefers heathland, but also found widely in pastures, grassy areas and low scrub; occurs in rocky ground, e.g. scree slopes, escarpments and crags. Never very far from water.

Food and Feeding. Predominantly vegetarian, eating seeds, fruits and green material, but also some terrestrial invertebrates. Chicks, and females in spring, consume relatively high proportions of invertebrates, mainly adult and larval insects, e.g. Orthoptera (grasshoppers), Coleoptera (beetles), Diptera (flies), Lepidoptera (caterpillars) and Formicidae (ants). Contents of 11 stomachs in Yugoslavia included fruits and seeds of grapes, assorted plant matter and grasshoppers, ants and beetles; those from French Alps had leaves and shoots of 5 plant species, *Gentiana lutea* seeds, a grasshopper and a snail; contents of 19 stomachs in Albania contained insects (grasshoppers, ants, beetles, bugs), molluscs, a spider and an isopod.

Breeding. Lays from mid-May to June in Alps, late Apr to Jun in Greece; break up of winter flocks from Feb, with territories established in Mar-Apr. Normally monogamous with long-term pair-bonds; some instances of successive bigamy reported, and some exchange of partners. Nest-site believed to be chosen by male, scrape excavated by female; laying occurs only when territory established; dominant males hold largest territories. Normally 8-14 eggs; incubation 24-26 days by female alone; chicks have cream and dark brown down above, paler below; young fully grown at 90 days, adult weight at 120 days.

Movements. Altitudinal movements reported in mountain breeding areas, but birds may remain at breeding altitude of 1900-2700 m in winter, if snowfall not too heavy. Odd occurrences in Romania in past may be consequence of local movements.

Status and Conservation. Not globally threatened. Mace-Land: Safe. Declining in most parts of its range; populations of c. 25% of localities in Italy lost since 1960's; thought to be stable at 7000-13,000 pairs in Greece; in Austria, where hunting was legal until 1968, still fairly common in W Carinthia, although bag records suggest numbers have declined in last 100 years; declining since about 1950 in France, where there are now 2000-3000 pairs in spring. Protected since 1990 in Turkey, as numbers have declined. In Austria, at least, species said to benefit from human presence in the hills (as do some of its predators), because it feeds close to settlements in winter; as humans have retreated from higher altitudes, so has present species. In the more typical Mediterranean part of its range, habitat loss and degradation are main pressures, mostly resulting from agricultural intensification and urbanization. Hunting, as well as direct effects, results in considerable pressure on habitat in some areas.

Bibliography. Bernard-Laurent (1986, 1988), Bernard-Laurent & Laurent (1984), Bernard-Laurent *et al.* (1992), Cramp & Simmons (1980), Dias (1992), Didillon (1988), Dragoev (1974), Fjeldså (1977), Glutz von Blotzheim *et al.* (1973), Gossow *et al.* (1992), Meinertzhagen (1954), Menzendorf (1976a, 1976b, 1976c, 1977, 1982), Niehammer (1942), Paganini & Meneguzzi (1992), Randi, Alkon & Meriggi (1992), Randi, Meriggi *et al.* (1992), Schonwetter (1967), Serez (1992), Simeonov *et al.* (1990), Spano (1978), Thomades *et al.* (1992), Watson, G.E. (1962a, 1962b).

12. Chukar

Alectoris chukar

French: Perdrix chukar **German:** Chukarhuhn **Spanish:** Perdiz Chukar
Other common names: Chukar/Chukor Partridge, Chukor

Taxonomy. *Perdix Chukar* J. E. Gray, 1830, India = Srinagar.

Previously placed in superspecies with *A. philbyi*, *A. barbara* and *A. rufa*, but now proposed to form superspecies with *A. magna*, *A. graeca* and *A. philbyi*. Has been included within *A. graeca*. *A. kakeik* is a synonym. Populations of Bulgaria and Crete have been separated in races *kleini* and *scotti* respectively, but usually included in *cypristes*; other proposed races are: *caucasica*, included in *kurdistanica*; *shestoperovi*, *laptevi* and *dementievi*, included in *koroviakovi*; and *obscureata*, included in *dzungarica*. Fourteen subspecies currently recognized.

Subspecies and Distribution.

A. c. cypristes Hartert, 1917 - SE Bulgaria E through Asia Minor to S Syria; S Aegean Is, Crete, Rhodes and Cyprus.

A. c. sinaica (Bonaparte, 1858) - N Syrian Desert S to Sinai Peninsula.

A. c. kurdistanica Meinertzhagen, 1923 - Caucasus S to Iran.

A. c. werae (Zarudny & Loudon, 1904) - E Iraq and SW Iran.

A. c. koroviakovi (Zarudny, 1914) - E Iran E to Pakistan.

A. c. subpallida (Zarudny, 1914) - Tajikistan.

A. c. falki Hartert, 1917 - Kazakhstan S to NC Afghanistan and E to NW China (W Xinjiang).

A. c. dzungarica Sushkin, 1927 - NW Mongolia, Altai Mts and E Tibet.

A. c. pallascens (Hume, 1873) - NE Afghanistan E through NW India to W Tibet.

A. c. pallida (Hume, 1873) - NW China (W & S Xinjiang).

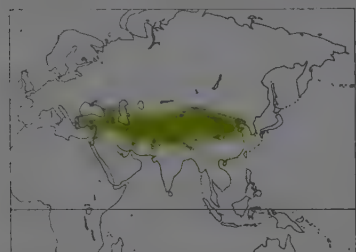
A. c. fallax Sushkin, 1927 - NW China, in Tien Shan Mts of NW Xinjiang.

A. c. chukar (J. E. Gray, 1830) - E Afghanistan E to Nepal.

A. c. pubescens (Swinhoe, 1871) - China, from W Qinghai and W Sichuan NE through Inner Mongolia to Liaoning.

A. c. potanini Sushkin, 1927 - W Mongolia.

Indeterminate mixed populations of present species and *A. graeca* introduced to UK, Russia, USA, Canada, Mexico, and New Zealand; Hawaiian birds known to derive from present species.



Descriptive notes. 32-39 cm; male 510-800 g, female 450-680 g; wingspan 47-52 cm. Difficult to separate in field from *A. graeca*; slight differences in extent of black pattern on head, upper breast and flank feathers; upperparts generally browner, less bluish grey. Female slightly smaller than male, with duller head pattern and no tarsal knob. Juvenile even smaller than female, with head and flank patterns scarcely appreciable. Races mainly separated on coloration: those of more humid areas darker and more olive above, richer buff below; those of more arid areas paler and greyer above, paler yellow below.

Habitat. Bare stony slopes with short grass, sparsely covered with short shrubs. Usually semi-arid and arid areas, from low plains up to 3000 m, locally to 4500 m. From dry valleys and near cultivation to steepest slopes with scattered scrub and trees in Bulgaria; found in small patches of heavily grazed forest in Kashmir; in Pakistan found in great variety of habitats in arid, rocky and hilly land, often in degraded scrub in foothills with *Dodonea* and *Reptonia* bushes, and among *Juniperus* forest at 3300 m in Baltistan. Often near cultivation, e.g. on terraced valley sides.

Food and Feeding. Bulbous roots, grain and shoots of grass and cereals, and insects. During periods of high rainfall, grass seeds dominate diet, and during hard winters birds dig extensively for bulbs and rhizomes. In Bulgaria, nearly 400 adults from all seasons had eaten mainly grass seeds, especially *Agrostis minor* and *Setaria viridis*, also tobacco (*Nicotiana tabacum*) seeds and those of weeds in autumn; some ants and other insects in summer. In Kashmir, in October species takes grass seeds, primarily *Eragrostis* and *Brachiaria*, and small proportion of insects. Small chicks in Bulgaria eat mainly weed and grass seeds; 37% of items are insects, including weevils, bugs and caterpillars; insects, primarily ants, taken until Sept.

Breeding. Laying mid-Apr to May in Mediterranean, rarely late Mar. In S Asia, early Apr to mid-Jul according to altitude; season long in Pakistan, with dates depending on altitude and latitude, from late Mar in Salt Range, not until late Jun in Kaghan Valley, where downy chicks seen at 3300 m in early Jul; most nesting Apr to mid-May. Usually monogamous; bigamy occasionally reported in USA. Nest is scrape sometimes lined with grass, leaves, etc.; under shelter, such as bush or overhanging grass. Usually 7-12 eggs, but 6-9 quoted for drier areas in Pakistan, and 15-19 in Kashmir, where rainfall heavier; incubation 22-25 days; chicks have cream and brown down above, paler below. Failure of spring rains in Kashmir adversely affects breeding; in good rains, two clutches recorded.

Movements. Descends in winter from upper altitudes. In mornings birds work their way uphill foraging. Strong, fast flier, but only over short distances; if pressed will fly downhill. In California, USA, released birds moved up to c. 52 km over two years; movements of up to 3-5 km in search of water in a day reported.

Status and Conservation. Not globally threatened. Mace-Land: Safe. Very widely distributed, both in native Palearctic range and also where introduced in USA. By 1980, populations considered locally reduced only in a few parts of its range, e.g. Greece (now believed stable at 11,000-16,000 pairs) and Lebanon; elsewhere mostly stable and locally increasing. In Azerbaijan, population reckoned to number 800,000 birds in 1955, but perhaps an overestimate; total estimated at 100,000-150,000 birds in 1993, apparently decreasing due to habitat loss, intensive hunting and poaching. In Pakistan much reduced in front ranges, some birds remaining in Kirthar Range in Sind, in parts of Salt Range, and in Margallas in Punjab; widespread in less accessible areas; population may fluctuate considerably. Total of c. 600,000 taken by hunters annually in USA, and 10,000 in Canada. Severe winters known to affect Turkish populations, and pesticides may now be a cause for concern; protected in Turkey since 1990. Suffering from habitat degradation in some areas.

Bibliography. Ali & Ripley (1980), Alkon (1979), Arnold & Ferguson (1962), Baker (1928), Bates & Lowther (1952), Bell & Summers (1982), Cheng Tso-hin (1987), Cramp & Simmons (1980), Dementiev & Gladkov (1952), Dias (1992), Eichécopar & Húe (1978), Flint *et al.* (1984), Gallagher & Woodcock (1980), Gaston *et al.* (1993), Glutz von Blotzheim *et al.* (1973), Goodman *et al.* (1989), Heinroth & Heinroth (1931-1933), Holmes (1986), Inskip & Inskip (1985), Kaul & Qadri (1989), Kuz'mina (1992), Lamba *et al.* (1987), Lever (1987), Liu Ming-yu *et al.* (1986), Mackie & Buechner (1951), Mallon (1987), Marchant & Higgins (1993), Meinertzhagen (1954), Menzendorf (1976a, 1976b, 1976c, 1977), Patrikeev (1993), Paz (1987), Pinshow *et al.* (1984), Portal (1924), Potapov & Flint (1989), Randi, Alkon & Meriggi (1992), Randi, Meriggi *et al.* (1992), Roberts (1991), Serez (1992), Simeonov *et al.* (1990), Stewart & Christensen (1971), Vaurie (1965J), de Vos & Karami (1977), Watson, G.E. (1962a, 1962b), Williams & Williams (1929), Zhang Yin-sun *et al.* (1989).

13. Philby's Partridge

Alectoris philbyi

French: Perdrix de Philby

German: Philbysteinhuhn

Spanish: Perdiz Gorginegra

Other common names: Philby's Rock-partridge

Taxonomy. *Alectoris philbyi* Lowe, 1934, Taif, Hejaz, SW Arabia.

Previously placed in superspecies with *A. chukar*, *A. barbara* and *A. rufa*, but now proposed to form superspecies with *A. magna*, *A. graeca* and *A. chukar*. Formerly included within *A. graeca*. Monotypic.

Distribution. SW Saudi Arabia and N Yemen.



Descriptive notes. 33-36 cm; one bird 441 g. Black chin, cheeks and throat differentiate present species from all other members of genus; otherwise very similar to *A. chukar*. Female slightly smaller than male, with duller head pattern and no tarsal knob.

Habitat. Arid rocky areas in montane regions; from 1400 m to 2950 m in Saudi Arabia and 2300 m to 3600 m in Yemen. Also occurs in highland cultivation. Similar habitat to *A. melanocephala*, but on slopes with more bush cover.

Food and Feeding. Believed to be similar to *A. melanocephala*.

Breeding. Season from late Mar. Clutch reported to be small; 5-8 eggs noted, but this observation is doubted.

Movements. No information available, but presumably sedentary.

Status and Conservation. Not globally threatened. Mace-Land: Safe. Locally common in Saudi Arabia and scarce in Yemen. Restricted range; occurs in Arabian Mountains Endemic Bird Area. Population trend unknown, but probably stable. No real threats known, but habitat alteration may have an effect in some areas; hunting is not systematic, and therefore not considered deleterious. Remoteness of montane habitat is best safeguard of species at present.

Bibliography. Hollom *et al.* (1988), Meinertzhagen (1954), Raethel (1988), Rahmani & Shobrak (1993), Randi, Alkon & Meriggi (1992), Randi, Meriggi *et al.* (1992), Rands *et al.* (1987), Stagg (1985), Watson, G.E. (1962a).

14. Barbary Partridge

Alectoris barbara

French: Perdrix gabra

German: Felsenhuhn

Spanish: Perdiz Moruna

Taxonomy. *Perdix Barbara* Bonnatere, 1792, no locality = Morocco.

Previously placed in superspecies with *A. chukar*, *A. philbyi* and *A. rufa*; now considered to be more distant from the reconstituted superspecies of *A. magna*, *A. graeca*, *A. chukar* and *A. philbyi*. Proposed races *theresae* and *duprezi* included respectively in *barbara* and *spatzi*. Four subspecies recognized.

Subspecies and Distribution.

A. b. koenigi (Reichenow, 1899) - NW Morocco.

A. b. barbara (Bonnaterre, 1792) - N Morocco and N Algeria; Sardinia (possibly introduced).

A. b. spatzi (Reichenow, 1895) - S Morocco, C Algeria and S Tunisia.

A. b. barbata (Reichenow, 1896) - Libya and NW Egypt.

Successfully introduced (*koenigi*) to S Spain and Canary Is. Introductions in rest of Europe, USA and Australia either unsuccessful from outset or populations died out.



Descriptive notes. 34-38 cm; male c. 461 g, female c. 376 g; wingspan 46-49 cm. Differs from other *Alectoris* by chestnut brown crown and broad neck band. Female almost identical to male, and only slightly smaller. Juvenile more uniform and yellowish. Races differ mainly in flank pattern, and also in overall tone of plumage coloration.

Habitat. Rocky areas and arid hillsides, and shrubby and wooded habitats up to 3300 m in Atlas Mts, where inhabits xerophytic vegetation: in sandy dunes and shrubby stands along dry river beds; also citrus plantations, areas of cropland, palm, citrus and olive groves, ma-

quis and areas with *Eucalyptus*, *Euphorbia*, etc. In Morocco, numbers highest in mixture of woodland, clearings and crops. Occupies similar habitat to that of *A. rufa* and *A. graeca*, where these species are absent.

Food and Feeding. Diet varied, but primarily leaves, shoots, fruits and seeds of wide range of grasses and herbs; insects, especially ants, are important supplement. Leaves of *Salsola*, *Lycium* and *Asparagus*, as well as fruits of *Euphorbia*, comprise up to one third of stomach contents; succulent leaves provide moisture. Young commonly feed on ants.

Breeding. Lays late Feb to mid-Jun in Morocco; elsewhere dates believed similar, mostly Mar-May; breeding earlier in lowlands than in mountains; in very dry years, breeding may not occur at all in semi-arid areas. Monogamous; pair formation in spring, when male starts calling. Nest is a depression on ground, usually with lining and placed under cover. Lays 6-20 eggs (mean of 25 clutches, 11-3); incubation c. 25 days; downy chicks are brown and cream above, paler below, with well marked streak over eye.

Movements. Mainly sedentary, but descends from upper zones of Atlas Mts during heavy winter snows.

Status and Conservation. Not globally threatened. Mace-Land: Safe. Has declined locally and is probably even extinct in some areas, e.g. coast of NW Egypt; elsewhere, in remote areas and where protected, common to abundant. Hunting pressure is main cause of local decreases in numbers throughout range, e.g. in Algeria, where occurs locally. The most important quarry species in N Africa; a rehabilitated area of 6500 ha near Rabat was restocked with some success during 1982-1991. Intensification of agricultural practices is also a major cause of declines in places.

Bibliography. Alaoui (1983, 1985, 1992), Bannerman (1963), Cramp & Simmons (1980), Eichécopar & Húe (1964), Fieldis (1977), Goodman *et al.* (1989), Hartert (1912-1922), Heim de Balsac & Mayaud (1962), Hollom *et al.* (1988), Lever (1987), Randi, Alkon & Meriggi (1992), Randi, Meriggi *et al.* (1992), Schönwetter (1967), Urban *et al.* (1986), Valverde (1957), Voous (1960), Wadsack (1992), Watson, G.E. (1962a, 1962b).

15. Red-legged Partridge

Alectoris rufa

French: Perdrix rouge

German: Rothuhn

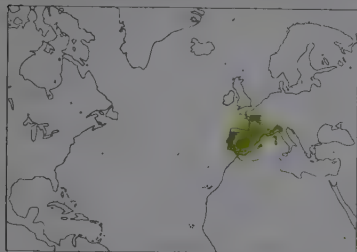
Spanish: Perdiz Roja

Taxonomy. *Tetrao rufus* Linnaeus, 1758, southern Europe = north Italy.

Previously placed in superspecies with *A. chukar*, *A. philbyi* and *A. barbara*; now considered to be more distant from the reconstituted superspecies of *A. magna*, *A. graeca*, *A. chukar* and *A. philbyi*. Population of Corsica has been separated in race *corsa*, but usually included in *rufa*; race *australis* described from Gran Canaria (Canary Is), where species is introduced. Three subspecies recognized.

Subspecies and Distribution.

A. r. rufa (Linnaeus, 1758) - France, NW Italy, Elba and Corsica.
A. r. hispanica (Seoane, 1894) - N & W Iberian Peninsula.
A. r. intercedens (A. E. Brehm, 1857) - E & S Iberian Peninsula and Balearic Is.
Introduced in several parts of Europe (e.g. Britain), and several Atlantic islands (Madeira, Azores, Canary Is); unsuccessfully in USA and New Zealand.



Descriptive notes. 34-38 cm; male 480-547 g, female 391-514 g; wingspan 47-50 cm. Best distinguished from other *Alectoris* by black mottling on breast and sides of neck; white forehead also distinctive. Female slightly smaller than male, with duller head and throat and no tarsal spur. Immature smaller and much duller with less extensive patterning. Races very similar, differing mainly in tone of plumage colour.

Habitat. Apparently less specialized than other *Alectoris*, ranging from Mediterranean to humid temperate zones, but not in boreal, oceanic or arid zones; prefers lowland areas.

Avoids forest and wet areas if possible; uses habitats with a wide variety of soils and land uses, again more varied than congeners. Dry, hilly land with scattered small bushes up to about 1300 m in montane foothills, but apparently on rare occasions as high as 2000 m, especially in S; from inhospitable dry terrain on lower mountain slopes to marginal cultivation, cropland, orchards, woodland, etc.

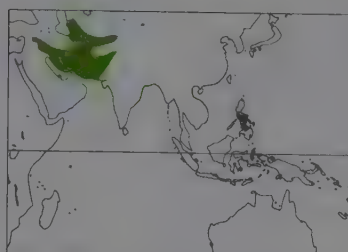
Food and Feeding. Seeds, leaves and roots; grasses and legumes especially important in winter. In Spain, predominantly wild and cultivated grasses and forage legumes, mainly vetches, *Vicia*, and other seeds and fruits on occasion; also ants, grasshoppers and other insects. In Portugal, various seeds and roots, grass foliage (mainly *Poa*) and legumes; roots such as *Poa*, *Ranunculus* and *Leontodon* in Aug-Oct; from Oct, grass leaves and legumes enter diet and become main components during winter; insects 3% by volume on average, but 10% in summer.

Breeding. Lays late Apr to early May in Portugal; late Apr to May in England; May to mid-Jun in France. Monogamous, with long-term bonds; occasionally bigamous. Nest-site chosen by male; nest, constructed by male, is scrape in ground lined with fairly few pieces of vegetation. Average 11-12-12.7 eggs; male will incubate if female absent, but usually female alone incubates; some cases of double-brooding reported, with second clutch started shortly after first, and parents incubating one clutch each; incubation 23-24 days; chicks have rich brown and cream down above, paler below; young tended by both parents if only one clutch, each clutch by one parent if two; chicks brooded when small; precocial flight at c. 10 days; full adult size at 50-60 days; remain with parents through first winter. Sexual maturity in first year.

Movements. Mostly sedentary, but some descent to lower ground noted in winter months.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Believed to have declined considerably in its native range; following decline in Liguria, Piemonte and adjacent regions in NW Italy, now stable at c. 1000-2000 coveys. In Portugal, declining and now scarce towards coastal regions; 6,200,000-7,400,000 birds may be shot each year, amounting to over 60% of estimated potential population; habitat fragmentation due to urbanization and agricultural expansion is also a problem; illegal importations of *A. graeca* and *A. chukar* may also be causing problems through hybridization and competition. Most valuable gamebird in Spain, where widely distributed; fairly common to common in areas of suitable habitat where not overhunted; restocking with captive-bred birds frequent in hunting areas. Wild stocks in Britain, where introduced, may now number 750,000 birds.

Bibliography. Bannerman & Bannerman (1965, 1966), Bernard-Laurent (1988), Brun & Aubineau (1989), Bump (1958), Cramp & Simmons (1980), Dias (1992), Didillon (1988), Fjeldså (1977), Fontana (1992), von Frisch (1962), Glutz von Blotzheim *et al.* (1973), Goodwin (1953, 1954, 1958), Green, R.E. (1984), Jenkins (1957), Lever (1987), Lucio (1989, 1990, 1991), Lucio & Purroy (1985, 1987, 1992), Marchant *et al.* (1990), Menzendorf (1976a, 1976c), Pepin (1984), Potts (1989), Randi, Alkon & Meriggi (1992), Randi, Meriggi *et al.* (1992), Rands (1988), Ricci (1983), Schönwetter (1967), Simeonov *et al.* (1990), Spano *et al.* (1989), Vaurie (1965d), Voous (1960).



Habitat. Dry and stony foothills that are lightly vegetated or bare; occasionally on plateaux up to c. 2000 m; sand dunes in some areas. Found in warmer, lower areas than *Alectoris chukar* where they are sympatric. Usually below 100 m in fairly arid foothills of mountains, and in deserts; flatter terrain preferred, often close to water. Not in narrow ravines, around crags or amongst thick tree cover.

Food and Feeding. Predominantly shoots and leaves, seeds and berries; also some insects. The herb *Trigonella occulta*, and flies, ants and beetles also recorded. Seen foraging around horse and mule droppings.

Breeding. Laying mid-Apr to Jul in former USSR; Mar-Jul in Pakistan; pairs seen in early Apr in Turkmenistan, in Feb in Iraq. Apparently monogamous; male may remain with female and young, but up to 20 males seen in groups during breeding season. Nest sited on exposed ground, but sheltered by grass or rocks; occasionally in small hollow. Usually 6-9 eggs (5-14); sometimes two clutches; incubation at least 21 days, by female only; chicks have rather uniform pale buff down above, whitish below. Female alone, or both adults, raise young, broods occasionally merging.

Movements. Usually sedentary, not normally moving higher in summer; recorded descending to flat plains at base of Salt Range in Pakistan. Flies only when strongly pressed, as is very swift runner; if alarmed on hillside will fly downhill.

Status and Conservation. Not globally threatened. Mace-Lande: Insufficient information. No direct information available; occurs at low densities but is widespread, and parts of range are unlikely to be disturbed by humans. Some human activities may increase access to surface water which may benefit the species. Distribution in SE Turkey believed to have expanded from Iraq border country since 1950, for reasons unclear; hunting banned in Turkey.

Bibliography. Ali & Ripley (1980), Allouse (1953), Cramp & Simmons (1980), Dementiev & Gladkov (1952), Flint *et al.* (1984), Hollom *et al.* (1988), Hüe & Etchécopar (1970), Knystautas (1993), Kuz'mina (1992), Maron (1951), Meinertzhagen (1920), Roberts (1991), Vaurie (1965d), Williams & Williams (1929).

17. Sand Partridge

Ammoperdix heyi

French: Perdrix de Hey German: Arabisches Wüstenhuhn Spanish: Perdiz Desértica

Taxonomy. *Perdix Heyi* Temminck, 1825, Desert of Aqaba, Arabia.

Race *intermedia* sometimes included within nominate *heyi*. Four subspecies recognized.

Subspecies and Distribution.

A. h. heyi (Temminck, 1825) - Jordan Valley S to Sinai Peninsula and through W Saudi Arabia.

A. h. nicolli Hartert, 1919 - N Egypt, E of R Nile, S to C Egypt.

A. h. cholmleyi Ogilvie-Grant, 1897 - C Egypt, E of R Nile, S to N Sudan.

A. h. intermedia Hartert, 1917 - S Arabia, from Aden E to Muscat, Oman, and Musundam Peninsula (UAE).

Introduced unsuccessfully to Cyprus.



Descriptive notes. 22-25 cm; c. 181 g; wingspan 39-41 cm. Male differs from *A. griseogularis* by chestnut throat and lack of pale neck spots; white marks on face lack black edges. Female sandier and greyer than male, with fewer markings; similar to that of *A. griseogularis*, but has pinkish bars, rather than white spots, on side of neck. Juveniles of both sexes apparently resemble adult female. Races differ in strength of overall colouring, with S races darker, and in presence or absence, and size, of white marks on forehead and lores of males; *cholmleyi* and *nicolli* generally lack pale line on forehead and white loreal spot.

although some individuals of *nicolli* can have small loreal spot.

Habitat. Desert and semi-desert, usually on steep, rocky slopes with scattered vegetation; boulder strewn, sandy bottomed wadis near hills and in hills, up to ridges over 2000 m, and down to c. 400 m below sea-level in Dead Sea Depression. Most abundant in valleys with some vegetation; rarely in uninterrupted stretches of dry, flat, open or sandy desert.

Food and Feeding. Mixed diet of seeds, berries and insects; eats mostly seeds in summer; often takes berries of *Salvadora persica* and *Commiphora*, as well as seeds of *Acacia* and grasses. Also bulbs and green leaves.

Breeding. Lays in Apr in N Africa, and apparently in Apr in Arabian Peninsula. Probably monogamous. Nest is a shallow scrape under cover of bush or rock; 5-7 eggs; chicks have pale buff down above, whitish below.

Movements. No information available.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Common in Oman, where population stable; widespread, common and probably stable throughout most of range in Saudi Arabia, UAE and Yemen; persecution probably very local. In NE Africa, status unclear in mid-1980's, but probably still at least frequent in most of range; no confirmed observations from Eritrea, despite some claims to the contrary. No specific threats known, partly because species inhabits areas considered inhospitable to humans; in Oman, drought, domestic stock grazing and urbanization all affect the species, but are not considered to pose threats.

Bibliography. Baker (1930), Benson (1970), Cramp & Simmons (1980), Etchécopar & Hüe (1964), Gallagher (1977), Gallagher & Woodcock (1980), Goodman *et al.* (1989), Hollom *et al.* (1988), Hüe & Etchécopar (1970), Jennings (1981), Kuz'mina (1992), Mackworth-Præd & Grant (1957), Meinertzhagen (1930, 1954), Par (1987), Pinshow *et al.* (1984), Richardson (1990), Schönwetter (1967), Urban *et al.* (1986).

Genus AMMOPERDIX Gould, 1851

16. See-see Partridge

Ammoperdix griseogularis

French: Perdrix si-si German: Persisches Wüstenhuhn Spanish: Perdiz Gorgigris

Taxonomy. *Perdix griseogularis* J. F. Brandt, 1843, Persia. Monotypic.

Distribution. SE Turkey and Iraq E to SE Uzbekistan, Tajikistan and Pakistan. Introduced unsuccessfully to USA.

Descriptive notes. 22-25 cm; 182-225 g; wingspan 40-42 cm. Male differs from that of *A. heyi* by having grey throat, pale neck spots and whitish eyestripe with black edges. Female similar to that of *A. heyi*, but white spots, rather than pinkish bars, on sides of neck. Juveniles of both sexes apparently resemble adult male, but with less clearly defined face pattern.



18

inches 8
cm 20
PLATE 44

19

ssp francolinus

ssp bogdanovi

ssp pondicerianus

20

21

ssp mecranensis

22

ssp coqui

23

ssp hubbardi

ssp buckleyi

ssp albogularis

25

24

ssp dewittei

26

On following pages: 22. Swamp Francolin (*Francolinus gularis*); 23. Coqui Francolin (*Francolinus coqui*); 24. White-throated Francolin (*Francolinus albogularis*); 25. Schlegel's Francolin (*Francolinus schlegelii*); 26. Latham's Francolin (*Francolinus lathamii*).

Taxonomy. *Tetrao pondicerianus* Gmelin, 1789, Pondicherry, India.

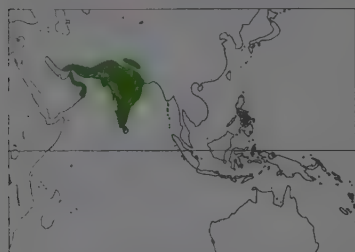
Recently proposed reorganization of *Francolinus* retains only *F. francolinus*, present species. *F. gularis*, *F. pictus* and *F. pintadeanus* in *Francolinus*. Present species has been placed in monotypic genus *Ortygornis*. Population of Sri Lanka has been awarded separate race, *ceylonensis*, but usually included within nominate. Three subspecies recognized.

Subspecies and Distribution.

F. p. mecranensis Zarudny & Härms, 1913 - SE Iran, Oman and S Pakistan.

F. p. interpositus Hartert, 1917 - S Pakistan (E Sind) through Nepal to NE India (Bihar and W Bengal). *F. p. pondicerianus* (Gmelin, 1789) - S India and NW coast of Sri Lanka.

Introduced into Amirante Is, Mauritius, Reunion, Seychelles, Rodrigues and Hawaiian Is; introduced populations of Andaman Is and Diego Garcia I now extinct.



Descriptive notes. 33-35 cm; male c. 274 g, female c. 228 g. Most uniformly and finely patterned Asian francolin; throat pattern, buffy throat fringed with black characteristic; chestnut outer rectrices are conspicuous in flight. Female similar to male, but lacks spurs. Immature similar to adult, but less clearly marked on head and throat. Races separated on pale to dark body coloration; *mecranensis* palest.

Habitat. Grassland and semi-thorny scrub; dry rolling plains and plateaus, especially in areas near village crops. Dryland conditions and degraded country with thorn scrub, often near scattered jowar, bajra and lentils, among other dry season crops. Can survive far from nearest water.

Food and Feeding. Seeds of weeds and cereals, grass and crop shoots, berries and drupes (*Zizyphus jujuba*, *Z. oenopia*, *Lantana*, *Capparis aphylla*); also takes insects, including grasshoppers, termites and maggots. Digs up small lizards (*Hemidactylus*, *Lacerta*) and succulent rhizomes of grasses.

Breeding. Eggs reported in every month in S Asia, but mostly Mar-Apr in Pakistan; nesting from Jan in Oman. Monogamous. Nest is a scrape, lined with grass and leaves; usually placed under cover, but sometimes exposed, in fields, shrubby gullies, hedges and amongst cacti; in Pakistan nest placed in grass clump within thorn bush. Lay 6-9 eggs; incubation 18-19 days, by female only. Both parents believed to raise young, with families staying together until autumn.

Movements. Sedentary. Flies only when very hard pressed, preferring to escape by running from bush to bush; when on the wing, alternates quick, strong flaps with glides of 50-100 m.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Very widely distributed, occurring in suitable habitat in an area over 1,000,000 km² in size. Common in Oman, where probably increasing its range by spreading into desert cultivation. Common in Pakistan, where large numbers taken for cage bird trade: widespread throughout Indus plains. Status in Nepal lowlands uncertain; common at Kohalpur in SW, and reported from several other sites. Major part of range is in India, where species is common and widespread throughout W & C India. Most frequent gamebird in most of its range, partly due to ability to inhabit a wide variety of arid vegetation types, and also to its tolerance of human activities. Pressures are mainly those affecting habitat, notably in form of degradation; pesticides connected with intensification of agriculture may be a problem in some areas.

Bibliography. Ali & Ripley (1980), Baker (1930, 1935) Bump & Bump (1964), Crowe & Crowe (1985), Crowe *et al.* (1992), Faruqi *et al.* (1960), Gallagher & Woodcock (1980), Hall (1963), Henry (1971), Hollom *et al.* (1988), Hue & Eichécor (1970), Inskipp & Inskipp (1985), Kaul & Howman (1991), Lever (1987), Meinertzhagen (1954), Phillips (1978), Richardson (1990), Roberts (1991), Sankar *et al.* (1993), Zacharias & Gaston (1993).

22. Swamp Francolin

Francolinus gularis

French: Francolin multiréa **German:** Sumpffrankolin **Spanish:** Francolín Palustre
Other common names: Swamp Partridge

Taxonomy. *Perdix gularis* Temminck, 1815, vicinity of Calcutta.

Recently proposed reorganization of *Francolinus* retains only *F. francolinus*, *F. pondicerianus*, present species, *F. pictus* and *F. pintadeanus* in *Francolinus*. Monotypic.

Distribution. NC India (Uttar Pradesh) and Nepal E to NE India (Assam) and Bangladesh.



Descriptive notes. c. 37 cm; male c. 510 g. Differs from other Asian *Francolinus* in strongly contrasting white stripes on underparts and rusty throat and foreneck. Chestnut outer tail feathers conspicuous in flight. Female similar to male, but lacks spur and has duller tarsus.

Habitat. Wet grasslands in low-lying land of terai and belt of alluvial plains; land prone to flooding in areas adjacent to Ganges and Brahmaputra river systems. In tall, dense grassland near marshy and swampy areas; also in sugar cane plantations around standing water in some areas, and in paddyfields.

Food and Feeding. Seeds of weeds and cereals, mustard, rice and other crop shoots; also insects. Emerges from tall grassland and cultivation, especially sugar cane, to forage on tracks with very short grass and around marshes in early morning and late afternoon.

Breeding. Lays from late Feb or Mar to May, mainly late Mar to Apr. Apparently monogamous. Nest is apparently often placed amongst reeds standing in water, in which case constructed from reeds, etc; alternatively at marsh edge, where nest is a more rudimentary structure. Normally 3-4 eggs (3-6); incubation by female only.

Movements. Sedentary, but will move to dry ground when low-lying areas around marshes are flooded. Flies out to feed on spring mornings, calling whilst in flight. Prefers to escape by running.

Status and Conservation. VULNERABLE. Mace-Lande: Vulnerable. Occurs in highly fragmented *terai* grassland. Locally common, but possibly as few as 1000-10,000 individuals remain, according to figures based on anecdotal information and some surveys. Recently reported from 12 protected areas (wildlife reserves, reserve forests, and national parks) in N India, ranging in size from 11 km² to 614 km², although extent of suitable habitat within each is unknown and probably very much smaller; suspected to occur at other localities. In Nepal, little suitable habitat now remains; recently recorded at Royal Sukla Phanta and Kosi Tappu Wildlife Reserves, and Royal Bardia National Park. Definitely declining outside protected areas due to habitat destruction, and appears for sale in markets in Lucknow from time to time, as is a popular pet in some parts of India. No recent records from Bangladesh, but could still occur in small numbers. May be dependent

upon protected areas for survival in long term, because of drainage of marshy areas for agricultural and other uses elsewhere; current protected area management is designed to benefit ungulates and may not be appropriate for present species. Likely to be affected by pesticides in run-off, where agriculture becomes intensive. Currently the subject of a detailed study designed to assess its distribution within and outwith protected areas, to investigate its use of sugar cane plantations, and to propose appropriate management techniques in protected areas.

Bibliography. Ali & Ripley (1980), Baker (1930, 1935), Collar & Andrew (1988), Crowe (1993), Crowe & Crowe (1985), Crowe *et al.* (1992), Hall (1963), Harvey (1990), Inskipp (1989), Inskipp & Inskipp (1986, 1985), Javed & Rahmani (1991), Kaul & Kalsi (1990), Rahmani & Qamar (1993), Sarker (1986), Shrestha (1992).

23. Coqui Francolin

Francolinus coqui

French: Francolin coqui **German:** Coquifrankolin **Spanish:** Francolín Coqui

Taxonomy. *Perdix Coqui* A. Smith, 1836, near Kurrichane, Transvaal.

Forms superspecies with *F. albogularis* and *F. schlegelii*; latter has been considered a race of present species. Recently proposed reorganization of *Francolinus* places present species in genus *Peliperdix* with *F. albogularis*, *F. schlegelii*, *F. lahami* and *F. sephaena*. Many other races have been described, but are currently considered doubtfully valid: *buckleyi* included in *spinetorum*; *thikae* in *maharao*; and *campbelli*, *vernayi*, *hoeschianus*, *angolensis*, *kasaicus* and *ruandae* in nominate *coqui*. Four subspecies recognized.

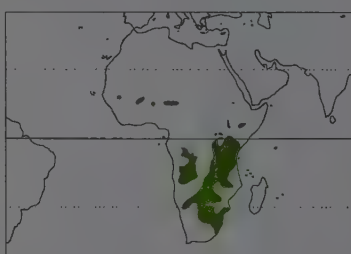
Subspecies and Distribution.

F. c. spinetorum Bates, 1928 - W Africa.

F. c. maharao W. L. Sclater, 1927 - Ethiopia, Kenya and N Tanzania.

F. c. hubbardi Ogilvie-Grant, 1895 - W & S Kenya S to Mwanza Province, Tanzania, and E to Kitui.

F. c. coqui (A. Smith, 1836) - NW Uganda S through Zaire and C Tanzania to C South Africa.



Descriptive notes. 20-25 cm; male 227-284 g, female 218-259 g. Male's uniformly ochre-coloured head contrasts sharply with barred breast; differs from *F. schlegelii* by lack of rufous on upperparts, which instead show dense barring, reminiscent of that found in *Coturnix*. Female has characteristic black and white face pattern. Immature similar to adult female, but paler, with more mottled rather than streaked upperparts; underparts more faintly barred. Races separated mainly by colour and pattern of underparts.

Habitat. Wide variety of grassy habitats, including savanna and wooded grassland, especially miombo woodland, up to 2200 m. Also found in sandy areas with bushes in drier country; frequents agricultural areas, but not considered a pest. Avoids hilly and stony land.

Food and Feeding. Seeds, including those of grass and grain, and leaves; also takes a variety of insects, including ants, beetles and larvae of other insects.

Breeding. Lays Jul in Nigeria; late Aug to Mar in Zaire; Oct-Apr (peak Nov-Feb) in South Africa; and possibly May-Jun in Ethiopia. Monogamous, and believed to be territorial. Nest is a slight hollow lined with grass, leaves and the like, at base of cover. Usually 4-5 eggs (2-8); chicks have buff and brown down above, buffy white below. Young stay with adults for several months; high predation rate.

Movements. Sedentary. Flies only when strongly pressed, preferring to escape by running.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. One of Africa's most widespread *Francolinus*, occurring in suitable habitat throughout an area of nearly 4,500,000 km². The only quantitative information available on abundance is that the mean density of five sites within Lake Mburo National Park, Uganda, was 3 birds/km² in 1980's. Abundance varies throughout range; uncommon and locally distributed in some parts of range, and common elsewhere. Specifically noted as rare in Mali, and uncommon to common in Ethiopia. Uncommon in Kruger National Park, South Africa. In Zimbabwe, hunting season should be limited to Jul-Sept. May be affected by disease, such as fowl pox, in some areas; known to be sensitive to state of grass cover, and disappears when areas are burnt or overgrazed.

Bibliography. Ash (1992), Bannerman (1953), Benson (1963), Benson & Benson (1975), Britton (1980), Clancey (1967, 1971), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Ginn *et al.* (1989), Hall (1963), Hartley & Mundy (1992), Jackson & Sclater (1938), Komen (1991b), Lewis & Pomeroy (1989), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Meyer (1971b), Pinto (1983), Pomeroy & Abe (1992), van Someren (1925-1935), Tait (1989), Urban *et al.* (1986), Vincent (1934), Woosnam (1912).

24. White-throated Francolin

Francolinus albogularis

French: Francolin à gorge blanche **German:** Weikehlfrankolin **Spanish:** Francolín Gorgiblanco

Taxonomy. *Francolinus albogularis* Hartlaub, 1854, Gambia.

Forms superspecies with *F. coqui* and *F. schlegelii*. Recently proposed reorganization of *Francolinus* places present species in genus *Peliperdix* with *F. coqui*, *F. schlegelii*, *F. lahami* and *F. sephaena*. Doubtfully valid races *meinerthageni* and *gambagae* included respectively in *dewittei* and *buckleyi*. Three subspecies recognized.

Subspecies and Distribution.

F. a. albogularis Hartlaub, 1854 - Senegambia to Ivory Coast.

F. a. buckleyi Ogilvie-Grant, 1892 - E Ivory Coast E to Cameroon.

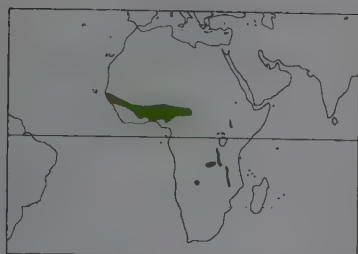
F. a. dewittei Chapin, 1937 - SE Zaire, NW Zambia and E Angola.

Descriptive notes. c. 23 cm; 263-284 g. Distinguished from other members of the red-tailed group by unbarred chestnut and buff underparts. Female has narrower creamy streaking on back and fine barring on breast and flanks. Immature similar to adult female, but usually with more barred underparts. Races separated mainly on pattern and colour of underparts and supercilium.

Habitat. Open, rolling savanna, especially disturbed areas, such as recently burned land, and along trails and in scrub on abandoned cultivation. In W Africa, apparently is not usually found far from cover, even when in cultivation.

Food and Feeding. A variety of insects, including grasshoppers and termites, and plant material, including grass seeds.

Breeding. Lays in Jun in Nigeria, Sept-Oct in Senegal and Gambia, and Oct-Dec in S Zaire. Probably monogamous. Nest is a slight hollow, lined with grass, leaves, etc. Usually 6 eggs (4-7); chicks have buff and brown down above, paler below.



Movements. Sedentary. Flies only when very pressed, preferring to escape by creeping through vegetation.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Widespread, occurring in suitable habitat throughout an area of over 1,000,000 km²; considered safe by virtue of large range and tolerance of disturbed habitats. Locally distributed and considered uncommon to rare throughout most of range; locally not uncommon in Ghana; only one recent record from Gambia. No further information available.

Bibliography. Bannerman (1953), Benson (1963), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Elgood (1982), Gore (1990), Grimes (1987), Hall (1963), Jensen & Kirkeby (1980), Komen (1991b), Lippens & Wille (1976), Mackworth-Præd & Grant (1962, 1970), Morel & Morel (1990), Pinto (1983), Urban *et al.* (1986).

25. Schlegel's Francolin

Francolinus schlegelii

French: Francolin de Schlegel **German:** Schlegelfrankolin **Spanish:** Francolín de Schlegel

Taxonomy. *Francolinus Schlegelii* Heuglin, 1863, Bongo River (= Bussere River), Bahr-el-Ghazal, Sudan.

Previously considered a race of *F. coqui*. Forms superspecies with *F. coqui* and *F. albogularis*. Recently proposed reorganization of *Francolinus* places present species in genus *Peliperdix* with *F. coqui*, *F. albogularis*, *F. lathamii* and *F. sephaena*. Monotypic.

Distribution. WC Cameroon E through N Central African Republic and S Chad to SW Sudan.



Descriptive notes. 21-24 cm; male c. 251 g, female c. 223 g. Usually more rufous than *F. coqui* and lacks white throat of *F. albogularis*. Female has browner back with narrower creamy streaking; also irregular belly markings. Immature similar to adult female, with barred scapulars and mantle.

Habitat. Savanna woodland, especially where tree *Isoberrinia doka* is numerous and grass cover plentiful. Not found near human settlements.

Food and Feeding. Takes leaves of *Isoberrinia doka*, and seeds of grass and grain; also feeds on caterpillars.

Breeding. In Sudan lays in Sept-Nov. Probably monogamous. Nest is a slight hollow lined with grass, leaves, etc. Usually 2-5 eggs; one record of 10 eggs is probably erroneous. No further information available.

Movements. Sedentary. Flies only short distances, remaining silent in process.

Status and Conservation. Not globally threatened. Mace-Lande: Insufficient information. Considered a candidate for inclusion in Red Data Book in 1985. A very poorly known species, that appears usually to stay far from human settlements. No surveys have been conducted and there is little recent information, but species is generally regarded as uncommon to rare and local. Possible threats are not documented. Extensive surveys required throughout range. It may prove necessary to manage the savanna habitat in some areas.

Bibliography. Bannerman (1953, 1957), Cave (1949), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Hall (1963), Komen (1991b), Louette (1981), Mackworth-Præd & Grant (1957, 1970), Nikolaus (1987), Traylor (1960), Urban *et al.* (1986).

26. Latham's Francolin

Francolinus lathamii

French: Francolin de Latham **German:** Lathamfrankolin **Spanish:** Francolín Cariblanco
Other common names: (Latham's) Forest Francolin

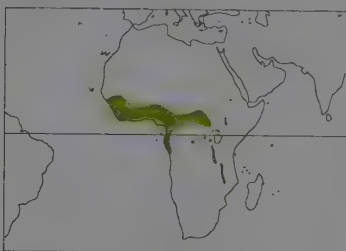
Taxonomy. *Francolinus Lathamii* Hartlaub, 1854, Sierra Leone.

Recently proposed reorganization of *Francolinus* places present species in genus *Peliperdix* with *F. coqui*, *F. albogularis*, *F. schlegelii* and *F. sephaena*. Two subspecies recognized.

Subspecies and Distribution.

F. l. lathamii Hartlaub, 1854 - Sierra Leone E to W Zaire and S to Cabinda, Angola.

F. l. schubotzi Reichenow, 1912 - W Zaire E to extreme SW Sudan, W Uganda and extreme NW Tanzania.



Descriptive notes. c. 23 cm; one male 254 g, one female 284 g. Male very dark; black throat contrasts conspicuously with white spotting below, a combination unique in *Francolinus*; recalls *F. nahani*, but lacks red facial skin, white throat and red legs. Female much browner. Immature similar to adult female, but more rufous above and whiter below. Male *schubotzi* has greyer face patch than nominate *lathamii*; that of female is more rufous.

Habitat. Equatorial lowland forest belt; primary forest, up to 1400 m in Uganda; occasionally also in secondary forest, sometimes far from primary forest, e.g. in Sierra Leone; uses gallery forest in Sudan, and coastal thicket in Ghana.

Food and Feeding. Termites (*Basidentitermes*), ants (*Psalidomyrmex*) and other arthropods, snails, beetles and similar comprise 90% of diet; 10% fruits, seeds and green leaves.

Breeding. Lays in Feb and Dec in W Cameroon; Dec (dry season) in S Cameroon; Dec-Apr in Zaire; Aug in Uganda; eggs recorded in Jan-Feb in Sierra Leone, in Feb in Ghana. Probably monogamous. Eggs laid on dry leaves between buttress roots of forest tree. Usually 2 eggs (2-3); chicks have chestnut brown down above, dark buff below. 80% hatching success in one study.

Movements. Sedentary. Flies only when very pressed, preferring to escape by running. Typical flight is short and fast.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Widespread, occurring in suitable habitat throughout an area of over 2,000,000 km². Only information on abundance is that species is generally uncommon, but locally common; not uncommon in Sierra Leone and Ghana; not often recorded in Uganda. Threatened by forest loss and easily caught by termite-baited snares, and shot at grain-baited sites. Known from at least six protected areas, Bugoma, Budango, Kalinzu, Kibale, Semliki and Mabira Forest Reserves, ranging in size from 137 km² to 793 km²; these areas are generally effective in conserving the species. Whilst there appears to be no immediate cause for concern, there is an obvious need to establish status of species in more detail, and to monitor extent of threats.

Bibliography. Bannerman (1930, 1953, 1957), Britton (1980), Brosset (1974), Chapin (1932), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Grimes (1987), Hall (1963), Komen (1991b), Lippens & Wille (1976), Mackworth-Præd & Grant (1957, 1970), Pinto (1983), Rodewald *et al.* (1994), Serle (1981), Thiollay (1971, 1973a, 1973b), Urban *et al.* (1986).



27. Crested Francolin

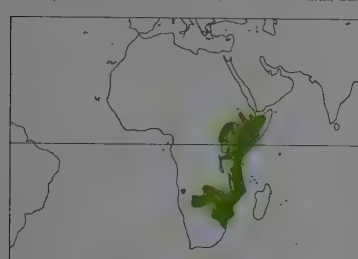
Francolinus sephaena

French: Francolin huppé German: Schopffrankolin Spanish: Francolin Capirotado

Taxonomy. *Perdix Sephaena* A. Smith, 1836, Marico River and Limpopo River, western Transvaal. Recently proposed reorganization of *Francolinus* places present species in genus *Perdix* with *F. coqui*, *F. albogularis*, *F. schlegelii* and *F. lathami*. Has been included with *F. streptophorus* in genus *Dendroperdix*. Race *rovuma* has been considered separate species, but hybridizes extensively with *spilogaster* in Kenya; this tendency has been attributed to destruction of habitat by humans. Five subspecies recognized.

Subspecies and Distribution.

F. s. spilogaster Salvadori, 1888 - E Ethiopia, Somalia and NE Kenya.
F. s. grantii Hartlaub, 1866 - S Sudan and W Ethiopia S to NC Tanzania.
F. s. rovuma G. R. Gray, 1867 - Kenyan coast S to N Mozambique.
F. s. zambezie Mackworth-Praed, 1920 - WC Mozambique W to NW Namibia and S Angola.
F. s. sephaena (A. Smith, 1836) - SE Botswana, SE Zimbabwe, S Mozambique and NE South Africa.



Descriptive notes. 30-35 cm; male 308-417 g, female 225-353 g. Chestnut blotching on neck and breast, black bill, red legs, white supercilium and dark brown crown distinctive; running bird often cocks tail and raises crown feathers. Female slightly smaller, with upperparts more densely barred. Immature similar to female but paler. Considerable variation, both individually and geographically, mostly in size and underpart coloration; race *rovuma* has blotching extended over most of underparts.

Habitat. Variety of brushland habitats with sparse ground cover including dense bushes

along rivers. *Acacia/Commiphora* woodland, forest edge and overgrown cultivation. In some areas can be found far from water, although often considered predictor of nearby water source; recorded up to 2200 m in Somalia.

Food and Feeding. Termites, other insects and their larvae, sedge bulbs and grasses, and a variety of other plant material; probably berries, molluscs and other food, as available. Seen foraging on elephant droppings.

Breeding. Lays Oct-Mar in South Africa; Jun-Jul in Mozambique; Mar-May in Ethiopia, and mainly May-Jun in Somalia. Probably monogamous. Nest is a hollow lined with grass and leaves at base of cover, well hidden. Usually 6 eggs (4-9); incubation c. 19 days; downy chicks are rufous brown, black and buff above, buffy white below.

Movements. Sedentary. Escapes by running in areas with little vegetation, but will flee mammalian predator by flying up into bush or tree; flight very fast, but not usually far.

Status and Conservation. Not globally threatened. Mace-Land: Safe. One of Africa's most widespread *Francolinus*, occurring in suitable habitat throughout an area of nearly 4,500,000 km². Locally common to abundant and probably stable throughout range; probably most widespread and plentiful gamebird in Kenya; uncommon in Kruger National Park, South Africa. No further information available on abundance. Not considered threatened anywhere, but habitat degradation and possibly conversion of savanna to agricultural land may affect the species; was considered to have declined in heavily populated Kisumu and in the coastal strip in Kenya in 1930's, as a result of habitat changes and shooting. Hunted in Zimbabwe, where shooting should be restricted to period Jul-Sept.

Bibliography. Archer & Godman (1937), Ash (1992), Ash & Miskell (1983), Benson (1963), Britton (1980), Clancy (1967), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Ginn *et al.* (1989), Haagner (1913b), Hall (1963), Hartley & Mundy (1992), Jackson & Selaier (1938), Komen (1991b), Lack (1985), Lewis & Pomeroy (1989), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Pinto (1983), Pomeroy & Abe (1992), Snow (1978), Swank (1977), Urban *et al.* (1986), Vincent (1934).

28. Ring-necked Francolin

Francolinus streptophorus

French: Francolin à collier German: Kragenfrankolin Spanish: Francolin Acolarado

Taxonomy. *Francolinus streptophorus* Ogilvie-Grant, 1891, Mangiki, Mount Elgon, Kenya. Forms superspecies with *F. africanus*, *F. levaillantii* and *F. finschi*. Recently proposed reorganization of *Francolinus* places present species in genus *Sclerophila* with *F. finschi*, *F. levaillantii*, *F. africanus*, *F. psilolaemus*, *F. shelleyi* and *F. levaillantoides*. Has been included with *F. sephaena* in genus *Dendroperdix*. Monotypic.

Distribution. Disjunct distribution, with four separate populations: in Uganda, from Kidepo National Park W to R Nile and S Katonga Valley and at base of Mt Moroto; in Kenya, from S slopes of Mt Elgon to Samia Hills and Nyando Valley; in NW Tanzania, in Kibondo and Kasulu districts; and an isolated population in highlands of Cameroon.



Descriptive notes. c. 33 cm; two males 364 g and 406 g. Distinctive black and white barring on upper breast extends round onto hind-neck. Female has dark brown crown and barred upperparts.

Habitat. Sparsely vegetated hillsides from 600 m to 1800 m, with thin covering of grass amongst rocks; occurs at 1050-1200 m in Cameroon; also affects wooded grassland and cultivation.

Food and Feeding. Known to eat insects and seeds and may visit cultivated areas, presumably to feed on weeds, crops and insects.

Breeding. Lays during early rains in Apr in Uganda; in dry season, Dec-Mar, in Kenya. Probably monogamous. Nest is a slight hollow with a sparse lining, often situated at the base of a rock. Usually 4-5 eggs.

Movements. Sedentary. Flies very fast, but usually runs into cover when alarmed.

Status and Conservation. Not globally threatened. Mace-Land: Safe. Occurs in suitable habitat throughout an area of c. 150,000 km². Was considered a candidate for inclusion in Red Data Book in 1985. Locally common to abundant, with populations apparently stable throughout range; occurrence sporadic in W Kenya, the E extremity of range. No further information available on abundance. Not considered threatened anywhere.

Bibliography. Bannerman (1953), Bates (1930), Britton (1980), Brown & Britton (1980), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Hall (1963), Jackson (1910), Jackson & Selaier (1938), Komen (1991b), Lewis & Pomeroy (1989), Louette (1981), Mackworth-Praed & Grant (1957, 1970), Urban *et al.* (1986).

29. Finsch's Francolin

Francolinus finschi

French: Francolin de Finsch German: Finschfrankolin Spanish: Francolin de Finsch

Taxonomy. *Francolinus Finschi* Bocage, 1881, Caconda, Benguela, Angola.

Forms superspecies with *F. streptophorus*, *F. levaillantii* and *F. africanus*. Recently proposed reorganization of *Francolinus* places present species in genus *Sclerophila* with *F. streptophorus*, *F. levaillantii*, *F. africanus*, *F. psilolaemus*, *F. shelleyi* and *F. levaillantoides*. Monotypic.

Distribution. Found in three areas: lower R Congo in Congo and Zaïre; Kwando Province, S Zaïre; and WC Angola.



Descriptive notes. c. 35.5 cm; c. 560 g. Differs from other red-winged francolins by grey breast and lack of black and white pattern on face and neck.

Habitat. Woodland and grassland; at Gungu in S Zaïre occurs in grassland near gallery forest up to 600 m; on Mt Moco in Angola found on bare slopes above the tree-line at 2100 m; elsewhere in wooded savanna and also in *Brachystegia* woodland.

Food and Feeding. Beetles, insect larvae and seeds are taken. No further information available.

Breeding. Lays Jan, Mar, Jul in Zaïre and Jun-Jul in Angola. Probably monogamous. Nest hidden amongst vegetation on ground. Lays c. 5 eggs.

Movements. Sedentary.

Status and Conservation. Not globally threatened. Mace-Land: Safe. Currently considered near-threatened. Occurs in suitable habitat throughout an area of about 180,000 km². In Angola, sparsely distributed and uncommon to rare; in Zaïre reasonably common around Gungu; no information from lower R Congo. Nothing known about either actual or potential threats. A detailed assessment of the species' status is needed, especially regarding its occurrence in protected areas, and also of the efficiency of such areas in safeguarding the species.

Bibliography. Chapin (1946), Collar & Stuart (1985), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Hall (1960a, 1960b, 1963), Komen (1991b), Lippens & Wille (1976), Mackworth-Praed & Grant (1962, 1970), Pinto (1983), Snow (1978), Traylor (1963), Urban *et al.* (1986).

30. Red-winged Francolin

Francolinus levaillantii

French: Francolin de Levaillant German: Rotflügelfrankolin Spanish: Francolin Alirrojo

Taxonomy. *Perdix Levaillantii* Valenciennes, 1826, Cape of Good Hope.

Forms superspecies with *F. streptophorus*, *F. africanus* and *F. finschi*. Recently proposed reorganization of *Francolinus* places present species in genus *Sclerophila* with *F. streptophorus*, *F. finschi*, *F. africanus*, *F. psilolaemus*, *F. shelleyi* and *F. levaillantoides*. Population of N Malawi has been awarded separate race, *crawshayi*, but validity doubtful. Two subspecies recognized.

Subspecies and Distribution.

F. l. kikuyuensis Ogilvie-Grant, 1897 - Angola, Zambia, NE & E Zaïre E to WC Kenya.
F. l. levaillantii (Valenciennes, 1826) - N Malawi and NE Zambia S to E South Africa.



Descriptive notes. c. 33 cm; male 369-567 g, female 354-454 g. Differs from other red-winged francolins by ochre band on sides of throat and broad black and white gorget. Immature paler, with less distinct gorget. Race *kikuyuensis* distinguished by having less black in gorget, and by underpart coloration.

Habitat. Moist montane and upland grasslands, at 1800-3000 m in Kenya, preferring steep-sided valleys and damp areas. In Kivu, Zaïre, found in grass along watercourses, in brush and woodland, and amongst grass in clearings and fields.

Food and Feeding. Predominantly bulbs and

corns, especially of *Amayllidaceae* and *fridaceae*; small amounts of plant material taken from above ground; rest of diet made up of invertebrates, including ants, spiders and millipedes. More invertebrates consumed in summer, and bulbs and corns in winter.

Breeding. Lays in most months in S of range, Mar-Jul in E Cape Province and Aug-Feb in Natal, in E Africa Jan-Apr, Aug and Oct-Nov, depending on locality. Probably monogamous. Nest is a slight hollow lined with grass, leaves and similar, at base of cover. Usually 3-4 (mean 3.5) downy chicks are dark brown with some buff above, buffy below, and darker on breast.

Movements. Sedentary. Flies fair distances, but only when strongly pressed; is a good runner.
Status and Conservation. Not globally threatened. Mace-Land: Safe. Occurs in suitable habitat throughout area of nearly 1,000,000 km². Distribution is extremely patchy. Generally uncommon, but locally common; average density of 2-4 birds/km², but 10-20 birds/km² in good habitat in South Africa. Numbers within any given area generally believed to be stable, but habitats containing species retreating where habitat degraded through burning and overgrazing, or where afforested. Occurs in

Natal Drakensberg Park; effectively protected areas are likely to be important for long-term survival of species, at least in South Africa; main threat seems to be pressure on habitat.

Bibliography. Benson (1963), Benson & Benson (1975), Britton (1980), Clancey (1967), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Ginn *et al.* (1989), Hall (1963), Komen (1991b), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Mentis (1973), Mentis & Bigalke (1973, 1979, 1980, 1981a, 1981b, 1985), Pinto (1983), Urban *et al.* (1986), Verheyen (1953).

31. Grey-winged Francolin

Francolinus africanus

French: Francolin à ailes grises **German:** Grauflügelfrankolin **Spanish:** Francolín Aligrís
Other common names: Greywing Francolin

Taxonomy. *Francolinus africanus* Stephens, 1819, Cape Province.

Forms superspecies with *F. streptophorus*, *F. levaillantii* and *F. finschi*. Recently proposed reorganization of *Francolinus* places present species in genus *Sclerophila* with *F. streptophorus*, *F. finschi*, *F. levaillantii*, *F. psilolaemus*, *F. shelleyi* and *F. levaillantoides*. *F. psilolaemus* has been included in present species. Monotypic.

Distribution. Lesotho and South Africa, from Cape Town E through Orange Free State and Natal to SE Transvaal.



Descriptive notes. 30-33 cm; male 345-539 g, female 354-369 g. Differs from other red-winged francolins by relatively small amount of chestnut in wings, narrow barring below and distinctive throat pattern. Immature duller with white throat.

Habitat. Montane grassland from about 1800 m to 2750 m in hills, occurring in patches of short grass and amongst small bushes; at sea-level in SW Cape Province, South Africa.

Food and Feeding. Predominantly bulbs and roots, especially of Amaryllidaceae, Cyperaceae and Iridaceae, for which digs with bill; small amounts of plant material taken from

above ground (e.g. fallen seeds and fruits); rest of diet made up of insects and other invertebrates, especially ants, beetles and grasshoppers in summer. Feeds in early morning and late afternoon.

Breeding. Lays Jul-Dec in Cape Province, Aug-Mar (peak Nov-Dec) in Natal, peak Oct-Dec in E Orange Free State; believed to begin earlier in E, S & W Cape, where rains are in winter, than Lesotho, Natal and extreme E Cape, where rains are in summer; gonadal development greatest during Jul-Dec in Natal and on Stormberg Plateau (E Cape). Monogamous and believed to be territorial. Nest is a slight hollow averaging 16.9 cm wide and 4.8 cm deep; lined with grass, leaves and occasionally feathers, at the base of a clump of grass. Usually 3-8 eggs (mean 5); incubation 21-22 days, by female only (male stays close by); downy chicks are mostly rufous brown and dark brown above, buffy below, washed rufous on breast. In summer rainfall area, longer breeding season may allow successful renesting, if first clutch fails. Hatching success 90%. Parents remain with chicks throughout the breeding season.

Movements. Sedentary. One covey in same area for 4 years.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Occurs in suitable habitat throughout an area of c. 500,000 km². In general, locally distributed and uncommon, but abundant in optimal habitat; densities of 1-3 birds/km² in Natal Drakensberg, 6-11 birds/km² on Stormberg Plateau and in Lesotho; in good habitat throughout range 10-20 birds/km² reported; numbers stable. Main threats are anticipated loss of habitat to cultivation and forestry in some places, and habitat degradation and overexploitation for food in Lesotho. Known from Natal Drakensberg Park and Cape Point Nature Reserve. Subject of a commercially viable sustainable hunting industry, which advocates "wise use" for conservation; habitat and population managed to this end. Research has proposed sound management practices to conserve numbers; in summer rainfall areas, hunting should be limited to period from mid-Apr to end July, and in winter rainfall areas from early Apr to end June. Veld burning should stop in late Aug to allow birds to breed. Both hunted and non-hunted populations cyclical, with similar levels of genetic variation; increased immigration into hunted populations probably reduces effects of hunting on genetic structure.

Bibliography. Clancey (1957, 1967, 1986), Crowe & Crowe (1985), Crowe *et al.* (1992), Earle, Huchzermeyer *et al.* (1991), Earle, Little & Crowe (1992), Ginn *et al.* (1989), Grant & Little (1992a, 1992b), Grant *et al.* (1991), Hall (1963), Komen (1991b), Komen & Little (1992), Little (1992), Little & Crowe (1992a, 1992b, 1993a, 1993b), Little, Earle *et al.* (1993), Little, Gous & Crowe (1993), Little, Grant & Crowe, P.G. (1993), Little, Grant & Crowe, T.M. (1991, 1993), Little, Verster & Crowe (1993), Mackworth-Præd & Grant (1957), Maclean (1993), Mentis (1973), Mentis & Bigalke (1973, 1979, 1980, 1981a, 1981b, 1985), Mentis & Little (1992), Parker (1963), Urban *et al.* (1986).

32. Moorland Francolin

Francolinus psilolaemus

French: Francolin montagnard **German:** Hochlandfrankolin **Spanish:** Francolín Etíope
Other common names: Montane/Shoa Francolin; Elgon Francolin (*elgonensis*)

Taxonomy. *Francolinus psilolaemus* G. R. Gray, 1867, Shoa, Ethiopia.

Forms superspecies with *F. shelleyi* and *F. levaillantoides*. Recently proposed reorganization of *Francolinus* places present species in genus *Sclerophila* with *F. streptophorus*, *F. finschi*, *F. levaillantii*, *F. africanus*, *F. shelleyi* and *F. levaillantoides*. Has been considered conspecific with *F. africanus*. Other races have been described, but validity doubtful: *ellenbecki* included in nominate *psilolaemus*; and *theresae* in *elgonensis*. Race *elgonensis* has been considered separate species, or race of *F. shelleyi*. Two subspecies currently recognized.

Subspecies and Distribution.

F. p. psilolaemus G. R. Gray, 1867 - Ethiopia.

F. p. elgonensis Ogilvie-Grant, 1891 - E Uganda to C Kenya.

Descriptive notes. c. 32 cm, two males 510 g and 530 g, two females 370 g and 510 g. Only red-winged francolin with black bars at tips of primaries; S birds larger, with richer colouring on head and back. Race *psilolaemus* has throat and breast distinctively patterned; *elgonensis* has extensive rufous on underparts.

Habitat. Confined to montane *Erica* moorland and grassland at 1800-4000 m.

Food and Feeding. Diet undescribed; believed likely to be dominated by bulbs and roots.

Breeding. Apparently recorded laying in all months except Sept-Oct, but mostly Jan-Jun. Probably monogamous. One nest was situated in rough grass. Coveys of 4-5 young and adults regularly seen, size of coveys decreasing as year progresses.



Bibliography. Ash (1992), Britton (1980), Britton & Sugg (1973), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Hall (1963), Komen (1991b), Jackson & Sciater (1938), Lewis & Pomeroy (1989), Sessions (1967), Urban *et al.* (1986).

33. Shelley's Francolin

Francolinus shelleyi

French: Francolin de Shelley **German:** Shelleyfrankolin **Spanish:** Francolín de Shelley

Taxonomy. *Francolinus shelleyi* Ogilvie-Grant, 1890, Hartley Hills, Umfuli River, Zimbabwe. Forms superspecies with *F. psilolaemus* and *F. levaillantoides*. Recently proposed reorganization of *Francolinus* places present species in genus *Sclerophila* with *F. streptophorus*, *F. finschi*, *F. levaillantii*, *F. africanus*, *F. psilolaemus* and *F. levaillantoides*. Several other races have been described, but validity doubtful: *uluensis*, *canidorsalis* and *sequestris* all normally included within nominate *shelleyi*. Dubious race *uluensis* has alternatively been considered a race of *F. africanus*. Race *elgonensis* of *F. psilolaemus* has been considered to belong to present species. Two subspecies normally recognized.

Subspecies and Distribution.

F. s. shelleyi Ogilvie-Grant, 1890 - S Uganda and SW Kenya S through Tanzania, S Zambia, S Malawi, Zimbabwe and Mozambique to NE South Africa and Swaziland.

F. s. whytei Neumann, 1908 - SE Zaire, N Zambia and N Malawi.

Descriptive notes. c. 33 cm; 397-600 g. In flight, shows small rufous patch in wing. Characteristic blackish barring on underparts, especially on belly. Immature paler. Races vary in coloration: *shelleyi* darker, with distinctive bold pattern on underparts; *whytei* less heavily marked black and white on underparts, with buff throat.

Habitat. Occurs in variety of grassland and woodland habitats: open montane wooded savanna and grassland, thornveldt and clearings in woodland, e.g. *Brachystegia* and mopane; commonly in rocky and stony areas. Also amongst crops. From coastal areas in Mozambique and Natal up to 2200 m in Inyanga Highlands of Zimbabwe, and 2450 m on Nyika Plateau in Malawi; from 700 m to 3000 m in E Africa.

Food and Feeding. Varied diet, including roots and bulbs, fallen seeds, and invertebrates, such as small molluscs, termites and ants, grasshoppers and locusts.

Breeding. Lays during dry season, varying with locality, and recorded in most months: Aug-Jan in South Africa, Mar-Jul in E Africa. Probably monogamous. Nest is a slight hollow lined with grass, leaves and the like, well hidden amongst grass, herbs or rocks. Usually 4-5 eggs (4-7) in S Africa, 3-4 in Malawi; incubation 22 days; chicks have mostly rufous brown down above, buffy below. High predation rate among chicks.

Movements. Sedentary. Flies only when very pressed, preferring to sit tight or escape by running; flies only short distance.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Very widely distributed species occurring in suitable habitat throughout area of c. 1,300,000 km². Considered to be generally common, but is rare in some areas. No further information available on relative abundance. Known to retreat from areas degraded as consequence of overgrazing and continual burning. May not be in need of immediate attention, but much more detailed data required on relative abundance and actual or potential threats.

Bibliography. Benson (1963), Benson & Benson (1975), Britton (1980), Clancey (1967, 1977), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Ginn *et al.* (1989), Hall (1963), Hartley & Mundy (1992), Komen (1991b), Lewis & Pomeroy (1989), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Meyer (1971a), Urban *et al.* (1986), Vincent (1934).

34. Orange River Francolin

Francolinus levaillantoides

French: Francolin d'Archer **German:** Archerfrankolin **Spanish:** Francolín del Orange
Other common names: Archer's Francolin; Acacia/Ethiopian Francolin (*gutturalis/lori*)

Taxonomy. *Perdix levaillantoides* A. Smith, 1836, upper reaches of Orange River.

Forms superspecies with *F. psilolaemus* and *F. shelleyi*. Recently proposed reorganization of *Francolinus* places present species in genus *Sclerophila* with *F. streptophorus*, *F. finschi*, *F. levaillantii*, *F. africanus*, *F. psilolaemus* and *F. shelleyi*. Several other races have been described, but their validity is doubtful: *pallider* and *kalaharica* normally included in nominate *levaillantoides*; *cunensis* in *jugularis*; and *archeri* in *lori*. Race *gutturalis* (incorporating *lori*) has been considered to constitute a separate species. *F. garipeensis* is a synonym for present species. Four subspecies currently recognized.

Subspecies and Distribution.

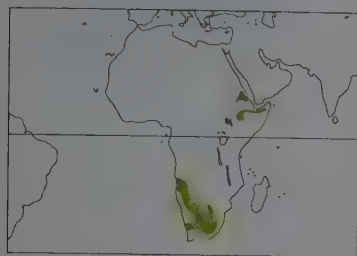
F. l. gutturalis (Rüppell, 1835) - N Ethiopia.

F. l. lori Sharpe, 1897 - Sudan E through S Ethiopia to Somalia, and S to Uganda.

F. l. jugularis Büttikofer, 1889 - SW Angola and N Namibia.

F. l. levaillantoides (A. Smith, 1836) - E Namibia, S Botswana, N & W South Africa and Lesotho.

Descriptive notes. c. 32 cm; male 370-528 g, female 379-490 g. Large rufous patch in wing is visible in flight. Immature duller, barred below, lacks black collar. Races separated by intensity of ground colour and also of underpart markings.



Habitat. Occurs in wide range of grassland and woodland habitats, ranging from boulder strewn grassy mountain slopes with thorn scrub, through scrubby grassland to dry woodland.

Food and Feeding. Bulbs and corms, fallen seeds and fruits, and insects, such as bugs, grasshoppers and beetles.

Breeding. Lays in Feb-May and Sept-Oct in Transvaal; Jun in Namibia; Aug in Angola; and Feb, Apr and Aug in Ethiopia. Probably monogamous; territorial. Nest is a slight hollow under a grass clump. Usually 5-8 eggs.

Movements. Sedentary.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Very widely distributed species occurring in suitable habitat throughout an area of c. 1,400,000 km². Frequent to common in Ethiopia and Somalia; formerly occurred in Djibouti. In South Africa only found in NW Cape Province, where probably numbers fewer than 500,000 individuals, and is thought to have declined during present century. In Namibia, numbers are stable and may be increasing. Possibly fairly common in Botswana; no information available from Angola, and no recent records from Lesotho. Occurs in Etosha Game Reserve and Daan Viljoen protected area in Namibia, but probably does not occur in any such reserve in South Africa; status in protected areas elsewhere not known; in Namibia these areas afford excellent protection, although species is widely distributed outside such reserves, and is unlikely to require protected areas for long-term survival. Main pressures are on habitat, with conversion to agricultural land and degradation through overgrazing. Species may not be in need of immediate attention, but more detailed data on abundance and actual or potential threats required. Two other fields of investigation merit consideration: research to provide a basis for protection and management; and promotion of sustainable sport hunting as a way of raising profile of Galliformes in Namibia, and providing an economic incentive for habitat conservation.

Bibliography. Ash (1992), Britton (1980), Brown & Britton (1980), Clancey (1967, 1986), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Ginn *et al.* (1989), Hall (1963), Komen (1991b), Lippens & Wille (1976), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Parker (1963), Pinto (1983), Urban *et al.* (1986), Wolff (1978).

35. Scaly Francolin

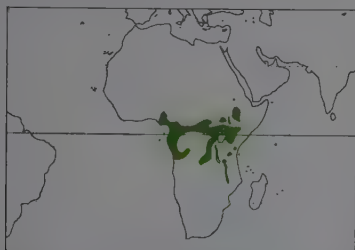
Francolinus squamatus

French: Francolin écaillé German: Schuppenfrankolin Spanish: Francolín Escamoso

Taxonomy. *Francolinus squamatus* Cassin, 1857, Cape Lopez, Gabon.

Forms superspecies with *F. achantensis* and *F. griseostriatus*; these three species have been separated in genus *Squamotocolinus*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Present species shows much internal variation and clinal extremes are sometimes accorded subspecific status, with up to seven different races having been proposed. Monotypic.

Distribution. Equatorial Africa between 10° N and 10° S: SC Nigeria SE to W Zaire and E to Uganda, S Sudan and SW Ethiopia, then S to E Zaire, NE Tanzania and extreme N Malawi; also recorded in C & S Zaire and WC Sudan.



Descriptive notes. c. 33 cm; male 372-565 g, female 377-515 g. A rather dark, heavily streaked species. Much variation, both locally and clinally; more mottled and blotched dorsally and paler ventrally in W than in E. Female tends to be smaller than male. Immature more rufous than female, with black markings.

Habitat. Evergreen forest with dense undergrowth from 800 m to 3000 m, including forest clearings; various secondary habitats, including plantations with dense undergrowth; found in small patches of forest and bush which have become quite isolated.

Food and Feeding. Fruits and seeds and a variety of crop plants, including sweet potatoes and groundnuts; also takes small insects, including termites and ants.

Breeding. Lays in all months except Feb in E Africa; lays Oct-Dec in Ethiopia and S Cameroon; Oct-Mar in W Cameroon; Jun-Aug in Gabon; Jan-Feb and May-Jun in Zaire. Probably monogamous. Nest is a slight hollow lined with grass, leaves and the like, under cover. Usually 6 eggs (3-8); downy chicks are mostly dark rufous brown above, buffy washed with rufous below. Chicks suffer heavy predation.

Movements. Sedentary. Prefers to sit tight rather than run if alarmed, but does fly up into trees.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Very widely distributed species occurring in suitable habitat throughout an area of c. 2,300,000 km². Common to abundant in Ethiopia; near Owerri, in Nigeria, it seems to be encountered c. 20 times more often than *F. bicalcaratus*. Widely distributed in most Ugandan forests, including a series of forest reserves and national parks. Main pressures are those affecting the forest habitat, but species is also trapped. Not in need of immediate attention, but more detailed data required on relative abundance and actual or potential threats.

Bibliography. Ash (1992), Bannerman (1930, 1953), Bates (1930), Benson (1963), Benson & Benson (1975), Britton (1980), Crowe (1993), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Hall (1963), Jackson & Selater (1938), Komen (1991b), Lewis & Pomeroy (1989), Mackworth-Præd & Grant (1957-1973), Marchant (1957), Pinto (1983), Pomeroy & Abe (1992), Rodewald *et al.* (1994), Serle (1981), Sessions (1966), van Someren (1916), Urban *et al.* (1986).

36. Ahanta Francolin

Francolinus achantensis

French: Francolin d'Ahanta German: Ahantafrankolin Spanish: Francolín de Ahanta

Taxonomy. *Francolinus achantensis* Temminck, 1851, Ahanta, Ghana.

Forms superspecies with *F. squamatus* and *F. griseostriatus*; these three have been separated in genus *Squamotocolinus*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. W populations have been awarded separate race, *happinsoni*, but variation is clinal and subspecific status not warranted. Monotypic.

Distribution. Occurs in three discrete areas in W Africa: W Senegal, Gambia, Guinea-Bissau and N Guinea; S Guinea, Sierra Leone and W Liberia; and NE Ivory Coast E to SW Nigeria.



Descriptive notes. c. 33 cm; male c. 608 g, female c. 487 g. Clinal variation, with paler, reddish brown wing-coverts to W. Female has darker secondaries. Immature has black arrow-shaped markings on mantle, scapulars and inner secondaries, underparts ashy.

Habitat. Edge and regrowth vegetation, such as forest edge, clearings and scrub between gallery forest and cultivation; thick undergrowth along watercourses and abandoned clearings. In Sierra Leone, most abundant in montane gallery forest; in Ghana, occurs in coastal thicket, and even recorded in teak plantation.

Food and Feeding. Varied diet, including seeds and small beans, cassava and large fruits, and insects.

Breeding. Little known. Lays in Jan and Sept in Senegambia; late Dec to Jan in Ghana and Sierra Leone. Nest is a scrape lined with leaves in cover. Usually 4-6 eggs (3-12); downy chicks have dark rufous brown upperparts, buffy with rufous wash below.

Movements. Sedentary. Flies only when very pressed, and then often perches in trees.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Occurs in suitable habitat throughout range of c. 200,000 km². Candidate for inclusion in Red Data Book in 1985. Rare and local in Gambia and N Guinea-Bissau; widespread in both Sierra Leone and Ghana, and common in latter; probably widespread but at low densities and likely to be declining in Ivory Coast; common in E of range. Occurs in Tai National Park, but much of this is unsuitable habitat, so species restricted to edge and regrowth areas in park. In Ivory Coast at least, threatened by conversion of habitat for agriculture and by overhunting for food; hunting has been somewhat reduced in Tai National Park. Not believed to be in need of immediate attention but more detailed data required on abundance and actual or potential threats.

Bibliography. Bannerman (1930, 1935, 1953), Collier (1935), Colston & Curry-Lindahl (1986), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Elgoud (1982), Grimes (1987), Hall (1963), Holman (1947), Komen (1991b), Mackworth-Præd & Grant (1970), Urban *et al.* (1986), White (1965).

37. Grey-striped Francolin

Francolinus griseostriatus

French: Francolin à bandes grises German: Graustreifenfrankolin Spanish: Francolín Angoleño

Taxonomy. *Francolinus griseo-striatus* Ogilvie-Grant, 1890, Quanza River, northern Angola.

Forms superspecies with *F. achantensis* and *F. squamatus*; these three have been separated in genus *Squamotocolinus*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Monotypic.

Distribution. Two disjunct populations in W Angola: S Cuanza and W Milanje; and S Benguela and extreme NE Huila.



Descriptive notes. c. 33 cm; male c. 430 g, female c. 390 g. Differs from other "scaly" francolins by rufous chestnut streaky breast, mantle and upperwing-coverts. Spurs lacking or rudimentary in female. Immature has black markings all over, with richer upperparts and paler underparts.

Habitat. Gallery forest and secondary forest in dense understorey, and dense thickets; occurs from 800 m up to 1200 m.

Food and Feeding. Not well documented; small arthropods, shoots and seeds. Feeds in grass and abandoned cotton fields next to forest in early morning and late afternoon.

Breeding. No information available.

Movements. Sedentary. Moves out from forest to feed in early morning and late afternoon. If alarmed, flies back to forest.

Status and Conservation. Not globally threatened. Mace-Lande: Insufficient information. Currently considered near-threatened. Status unknown and species not recorded since 1954; most records are of specimens collected before 1910. Civil strife currently widespread throughout known range. Possible presence of species in protected areas unknown; occurs in Angola Endemic Bird Area. No threats identified, due to general lack of data; forest destruction may be a problem. Extensive survey urgently needed to assess status and recommend future actions, but military situation currently precludes this.

Bibliography. Collier & Slogar (1985), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Hall (1960b, 1963), Heinrich (1958), Komen (1991b), Mackworth-Præd & Grant (1962), Pinto (1970, 1983), Urban *et al.* (1986).



38. Nahan's Francolin

Francolinus nahani

French: Francolin de Nahan German: Nahanfrankolin Spanish: Francolín de Nahan
Other common names: Nahan's Forest Francolin

Taxonomy. *Francolinus nahani* Dubois, 1905, Popoie, Aruwimi River, Zaïre. Formerly placed in monotypic genus *Acentorhynchus*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Monotypic.
Distribution. NE Zaïre (area bordered by R Aruwimi, R Nepoko and R Semliki) and W & SC Uganda (forests of Budongo, Bugoma and Mabira).



Descriptive notes. 23-26 cm; two males 308 g and 312 g, three females 234-260 g. Unspurred; distinctive combination of bare red skin around eyes, mostly white throat and black and white remainder of underparts. Immature darker, with grey legs.
Habitat. Inhabits dense primary forest up to altitude of 1400 m.
Food and Feeding. Varied diet, including invertebrates (insects and small molluscs), shoots, seeds and bulbs. Scratches leaf litter to find food. Specimens have been obtained by baiting with grain.
Breeding. Believed to breed throughout year.

Probably monogamous. Only known nest was in tree hollow, 1 m above ground; clutch of 4 eggs.
Movements. Sedentary.

Status and Conservation. RARE. Mace-Lande: Insufficient information. Very poorly known, with little recent information. Presumed to be declining due to loss of habitat and hunting. Occurs in Bugoma, Kibale and Mabira Forest Reserves; population in Semliki Valley is within Virunga National Park, and would be best protected by extension of this park to include E Ituri Forest. Loss of tree cover due to timber extraction and overexploitation for food are possible threats. An extensive survey is needed in order to permit assessment of the species' status in both Uganda and Zaïre.

Bibliography. Britton (1980), Chapin (1926, 1932), Collar & Andrew (1988), Collar & Stuart (1985), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Dubois (1905), Friedman (1966), Friedman & Williams (1973), Hall (1963), Jackson & Selater (1938), Komen (1991b), Lippens & Wille (1976), Mackworth-Præd & Grant (1957, 1970), Schoueden (1918, 1963, 1968), van Someren (1916, 1918, 1922, 1926), Urban *et al.* (1986).

39. Hartlaub's Francolin

Francolinus hartlaubi

French: Francolin de Hartlaub German: Hartlaubfrankolin Spanish: Francolín de Hartlaub

Taxonomy. *Francolinus Hartlaubi* Bocage, 1869, Huila, southern Angola.

Has been included in genus *Chaetopus*, or separated in monotypic genus *Chapinortyx*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Monotypic.

Distribution. SW Angola (from Benguela) S to C Namibia around Tropic of Capricorn.



Descriptive notes. Male c. 28 cm, 245-290 g; female c. 25 cm, 210-240 g. Male differs from similar species in head and underpart coloration. Female very different, with distinctive greyish neck and pale cinnamon brown underparts. Some geographical variation, with birds at centre of range darker than those to N and S. Immature male paler above than adult male, with narrower streaks below; immature female similar to adult female.
Habitat. Hills, kopjes, ridges and mounds covered with scrub, bushes and grasses on a sandy soil.
Food and Feeding. Berries, bulbs and seeds;

also invertebrates, including small snails and insects.

Breeding. Apr-Aug in Namibia, also Nov and Feb; season possibly varies with rainfall. Monogamous and territorial. Only 1 nest described, in hollow on cliff ledge. Clutch probably 4-8 eggs. Family parties seen for some months after hatching.

Movements. Sedentary.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Occurs in suitable habitat throughout a range of c. 300,000 km². Considered a candidate for inclusion in Red Data Book in 1985. Believed rare and locally distributed in a restricted habitat type; possibly stable overall, but numbers may be declining in Namibia; no recent information from Angola. Known from Waterburg Plateau and Daan Viljoen Parks in Namibia, and Iona National Park in Huila, Angola; Waterburg, at least, provides effective protection, and these and any other protected areas may become very important in the long-term conservation of present species. As it occurs on granitic hills, it is suffering from consequences of granite extraction in some areas. Not believed to be in need of immediate attention but much more detailed data on relative abundance and actual or potential threats required.

Bibliography. Clancey (1967, 1986), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Ginn *et al.* (1989), Hall (1963), Komen (1986, 1987, 1990, 1991b), Komen & Little (1992), Komen & Meyer (1984), MacDonald (1957), Mackworth-Præd & Grant (1962), Maclean (1993), Pinto (1983), Urban *et al.* (1986).

40. Double-spurred Francolin

Francolinus bicalcaratus

French: Francolin à double éperon German: Doppelspornfrankolin Spanish: Francolín Biespolado

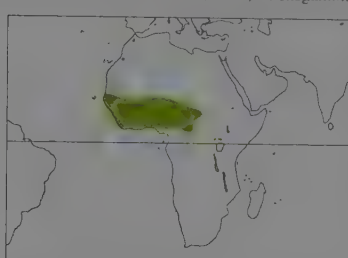
Taxonomy. *Tetrao bicalcaratus* Linnaeus, 1766, Senegal.

Forms superspecies with *F. clappertoni*, *F. icterorhynchus* and *F. harwoodi*. Has been included in genus *Chaetopus*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Several races proposed, but these are simply examples of both local and clinal variation within nominate *bicalcaratus*. Two subspecies recognized.

Subspecies and Distribution.

F. b. ayesha Hartert, 1917 - W Morocco, from Rabat to Mogador.

F. b. bicalcaratus (Linnaeus, 1766) - Senegambia E to SW Chad and W Central African Republic



Descriptive notes. 30-34 cm; male c. 507 g, female c. 381 g; wingspan 45-50 cm. Differs from similar francolins by leg colour and lack of bare skin around eye. Female averages smaller, with much reduced spurs. Immature duller and more heavily barred. Birds in S and E of range are darker; race *ayesha* larger, paler above and with less chestnut below.

Habitat. Wide variety of open habitats from moist savanna to arid savanna and from *Cistus* heath to woodland; man-made habitats, such as farmland, pastures and abandoned cultivation. Seldom far from human habitation. In Morocco, occurs in moister Mediterranean

vegetation in lowlands of Atlantic coast; mainly in forest or woodland fringes. Not far from water.
Food and Feeding. In W Africa is opportunist, diet varying somewhat with habitat. Mostly plant matter, such as fruit, roots and green leaves and some crop seeds (millet, groundnuts, etc.); also frogs, small molluscs, termites, caterpillars and other insects and their larvae. Feeds mainly in early morning and late afternoon, but throughout day during rainy season.

Breeding. Lays in all months according to locality; thought to be May in Morocco (*ayesha*); in Senegambia and E of range, Jan-May and Aug-Dec where water present, otherwise during rains; Sept-Mar in Sierra Leone; Aug-Feb in Ivory Coast; in Mali, all months in S, Aug-Oct in Sahel; Sept in Niger; Oct and Feb in Benin; Sept-Mar in Nigeria; Oct-Dec in S Cameroon. Probably monogamous. Nest is a hollow occasionally lined with grass, leaves and similar material, at base of cover. Usually 6 eggs (5-7); downy chicks have broad dark rufous brown central stripe above, creamy buff underparts. Average 70% of chicks survive to fledging.

Movements. Sedentary. Active in early morning and late afternoon, moving into shade during hottest part of day. Flies strongly 4-5 m above ground for less than 200 m, but only when strongly pressed; prefers to run away.

Status and Conservation. Not globally threatened. Mace-Lande: *bicalcaratus* safe; *ayesha* endangered. Nominative *bicalcaratus* considered commonest W African non-forest francolin in mid-1980's; ranges from common in Gambia, to abundant in Sierra Leone and locally in Ghana. Race *ayesha* treated separately because of very small, isolated distribution: one known and one possible location, Sidi Bettache and Moulay Bouazza respectively; in 1970's birds heard calling at Sidi Bettache only, despite intensive searches in Forest of Mamora too; Sidi Bettache is protected. This race considered a cause for concern, but detailed information lacking; believed to have increased in number between 1982 and 1988, with at most a few hundred birds in 1988; current status unknown; believed to be threatened by habitat degradation and overexploitation for food. Nominative *bicalcaratus* overhunted outside protected areas in Ivory Coast. Extensive surveys should aim to identify other areas with potential for protection, and research to guide management would be beneficial, as would monitoring of known populations.

Bibliography. Akande (1977), Bannerman (1930, 1953, 1957), Bates (1930), Cramp & Simmons (1980), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Etchécopar & Hue (1964), Fairbairn (1952), Ginn (1987), Hall (1963), Heim de Balsac & Mayaud (1962), Heinze & Knott (1979), Hollom *et al.* (1988), Hopkinson (1923), Komen (1991b), Mackworth-Præd & Grant (1970), de la Perche (1992), Thiollay (1970), Urban *et al.* (1986), Walls (1933).

41. Heuglin's Francolin

Francolinus icterorhynchus

French: Francolin à bec jaune German: Gelbschnabelfrankolin Spanish: Francolín Piquigualdo

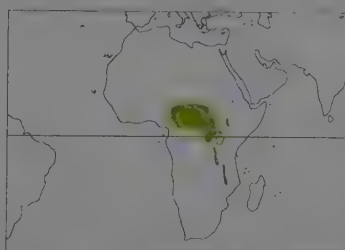
Other common names: Yellow-billed Francolin

Taxonomy. *Francolinus icterorhynchus* Heuglin, 1863, Bongo River, Bahr-el-Ghuzal, Sudan.

Forms superspecies with *F. clappertoni*, *F. bicalcaratus* and *F. harwoodi*.

Has been included in genus *Chaetopus*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Proposed race *dybowskii* is an example of clinal variation and does not merit subspecific status. Monotypic.

Distribution. Central African Republic, S Sudan, N Zaïre and W Uganda.



Descriptive notes. c. 32 cm; male 504-588 g, female 420-462 g. Differs from *F. bicalcaratus* by peculiar markings below and by having bill and legs yellow to orange, rather than greenish; from *F. clappertoni* by yellow, not red, bare parts. Female averages smaller, with much reduced spurs. Immature has more distinct barring on upperparts. Birds in E are darker.

Habitat. Open habitats between 500 m and 1400 m, ranging from grassland to savanna with scattered tree cover; also in cultivation.
Food and Feeding. Varied diet includes seeds and berries, millipedes, beetles and termites.
Breeding. Lays in Feb, Apr-Jul and Oct in

Uganda, apparently unrelated to rains; Sept-Nov in Zaïre, during late rainy season. Probably monogamous. Nest is a scrape in ground, in cover. Usually 6-8 eggs; downy chicks have broad rufous brown and dark brown central stripe above, buffy underparts.

Movements. Sedentary. Flies up to perches only when very pressed, preferring to escape by running into cover.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Widely distributed, occurring in suitable habitat throughout a range of about 1,400,000 km². Common to abundant in most parts of range. Not in need of conservation attention.

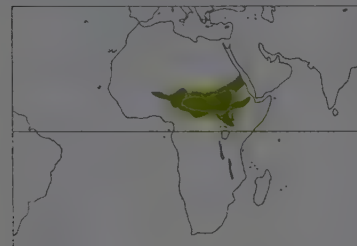
Bibliography Britton (1980), Brown & Britton (1980), Chapin (1932), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Hall (1963), Jackson & Sclater (1938), Komen (1991b), Lippens & Wille (1976), Mackworth-Præd & Grant (1970), Nikolaus (1987), Urban *et al.* (1986), White (1965).

42. Clapperton's Francolin *Francolinus clappertoni*

French: Francolin de Clapperton **Spanish:** Francolín de Clapperton
German: Clappertonfrankolin

Taxonomy. *Francolinus Clappertoni* Children, 1826, no locality = Bornu. Forms superspecies with *F. icterorhynchus*, *F. bicalcaratus* and *F. harwoodi*. Has been included in genus *Chaetopus*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Various races proposed, including *sharpii*, *konigseggii* and *nigrosquamatus*, but geographical variation in plumage is complex and validity of races is dubious. Monotypic.

Distribution. E Mali (from Azzawak) E through C Niger, NE Nigeria, N Cameroon, S Chad and S & C Sudan to N Uganda and Ethiopia.



Descriptive notes. c. 32 cm; male c. 604 g, female c. 463 g. Differs from *F. icterorhynchus*, *F. hildebrandti* and *F. bicalcaratus* by red patch around eye; white throat and fore-neck also distinctive. Much variation in extent of moustachial stripe and of brown markings below. Female averages smaller, with much reduced spurs. Immature less distinctly marked.

Habitat. Semi-arid savanna, open savanna woodland and especially sandy grassland, including that of *Hyparrhenia*, with trees and bushes, e.g. *Acacia*, *Terminalia*, *Combretum*; occurs up to 2300 m; also in cultivation and

on rocky hillsides.

Food and Feeding. Seeds and berries, small molluscs and insects.

Breeding. Lays Aug-Sept in Mali and Sudan; Jul-Sept in Chad; Feb-Mar in Nigeria; Feb and Apr-Dec in Ethiopia. Probably monogamous. Nest is a well hidden hollow on ground. Clutch size unknown; maximum of 4 young seen with adult.

Movements. Sedentary. Often active in late afternoon.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Patchily distributed in suitable habitat within a large range of c. 2,000,000 km². Generally locally common to abundant, e.g. common in Waza and Kalamaloué National Parks, N Cameroon. Decreasing in some areas, at least in Ethiopia, e.g. Rift Valley, due to degradation of habitat and its conversion for agriculture; overhunting is also problem in some areas. Not in need of conservation attention.

Bibliography Ash (1992), Bannerman (1953), Britton (1980), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Hall (1963), Komen (1991b), Mackworth-Præd & Grant (1957, 1970), Nikolaus (1987), Salvan (1978), Urban *et al.* (1986).

43. Harwood's Francolin *Francolinus harwoodi*

French: Francolin de Harwood **German:** Harwoodfrankolin **Spanish:** Francolín de Harwood

Taxonomy. *Francolinus harwoodi* Blundell and Lovat, 1899, Aheafeg, Shoa, Ethiopia. Forms superspecies with *F. icterorhynchus*, *F. bicalcaratus* and *F. clappertoni*. Has been included in genus *Chaetopus*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Monotypic.

Distribution. Very small range in highlands of C Ethiopia around R Blue Nile and its tributaries, occurring locally at and around Aheafeg, Jemmu Valley, Kalo Ford, R Muger and a few other sites.



Descriptive notes. c. 33 cm; one male 545 g, one female 446 g. Differs from *F. natalensis* by head pattern and more black and buff underparts. Female has slightly paler, browner underparts, with spurs much reduced.

Habitat. Large, dense *Typha* beds with scattered trees, along small, shallow watercourses; feeds in adjacent sorghum fields. Possibly also *Terminalia/Combretum* woodland with tall *Hyparrhenia* grass.

Food and Feeding. Tubers, possibly those of *Dioscorea*; seeds, including those of the grass *Echinochloa*; berries, including *Amaranthus*; sorghum; and fruit; also termites.

Breeding. Only information is a brood of 3, about 5 weeks old, seen in mid-Feb; first egg probably laid in early to mid-Dec.

Movements. Sedentary. Moves out into sorghum fields to feed; if alarmed, flies back into reedbeds.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Currently considered near-threatened. Little known, but considered locally common in suitable habitat within c. 50,000 km². Restricted range; occurs in Central Ethiopian Highlands Endemic Bird Area. Status requires clarification: as species is Ethiopian endemic, its habitat is likely to be under pressure from expanding human population; species may be trapped in increasing numbers, as reported to be excellent food. Not reckoned to need immediate attention, but more detailed data required on abundance and actual or potential threats.

Bibliography Ash (1978, 1992), Ash & Gullick (1989), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Hall (1963), Komen (1991b), Mackworth-Præd & Grant (1957), Urban (1980), Urban *et al.* (1986).

44. Red-billed Francolin *Francolinus adspersus*

French: Francolin à bec rouge **German:** Rotschnabelfrankolin **Spanish:** Francolín Piquirrojo

Taxonomy. *Francolinus adspersus* Waterhouse, 1838, Great Fish River, Great Namaqualand.

Has been included in genus *Notocolinus*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Monotypic.

Distribution. S Angola S through Namibia to extreme N South Africa; S Zambia, W Zimbabwe, Botswana.

Probably introduced successfully to Hawaii.



Descriptive notes. Male c. 38 cm, 340-635 g; female c. 33 cm, 340-549 g. Shows rather conspicuous and very distinctive yellow eye-ringing and finely barred underparts. Female averages smaller than male, with much reduced spurs. Immature much browner with buff bars and streaks.

Habitat. Arid savanna and floodplains; *Baikaiea*, *Acacia* and mixed woodlands, brush country and thickets, often near water.

Food and Feeding. Green parts of plants, berries and bulbs, and termites, beetles, grasshoppers and bugs; in Zambia known to eat seeds of the tree *Guibouria coleosperma*, and in

Namibia fruits of devil thorn (*Tribulus terrestris*).

Breeding. Breeds in late rains or early dry season; mainly Dec-Apr, but any month, in C & S Namibia; mainly Apr-Jun in N Namibia and Botswana; May in Zambia; Jan-Mar, May, and Jul-Aug in Zimbabwe. Probably monogamous. Nest is a hollow under a bush. Lays 4-10 eggs; incubation 22 days (in captivity); downy chicks have broad dark brown central stripe above, pale yellowish buff below, with darker breast; adult plumage attained at c. 3 months, spurs evident at c. 5 months.

Movements. Sedentary; occurs at higher altitudes during floods. Active in early morning and late afternoon, moving to shade during the heat of the day. Flies only when strongly pressed, preferring to escape by running, but will fly up into trees.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Occurs in suitable habitat throughout c. 700,000 km². Considered widespread and abundant in Namibia, where numbers are stable; occurs in most protected areas in the country, although its survival is not likely to depend upon such areas. In Zimbabwe, only occurs in NW, much of which is protected or safari land where hunting is permitted and a Dec-Mar shooting season is recommended. Not in need of conservation attention; sport hunting may be considered as a means of raising funds for protection of both species and habitat.

Bibliography Benson (1963), Clancey (1967, 1986), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Ginn *et al.* (1989), Hall (1963), Hartley & Mundy (1992), Komen (1991b), Komen & Little (1992), Mackworth-Præd & Grant (1962), Maclean (1993), Mallet (1964), Pinto (1983), Urban *et al.* (1986).

45. Cape Francolin *Francolinus capensis*

French: Francolin criard **German:** Kapfrankolin **Spanish:** Francolín de El Cabo

Taxonomy. *Tetrao capensis* Gmelin, 1789, Cape of Good Hope.

Has been included in genus *Notocolinus*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Monotypic.

Distribution. South Africa, in S & W Cape Province from Cape Peninsula E to E Cape; presence on lower Orange R currently considered doubtful.



Descriptive notes. 40-43 cm; male 600-915 g, female 435-659 g. Rather dark overall, with distinctive pattern of white streaks and vermiculations. Female averages smaller, and has legs dull orange, not orange-red, with much reduced spurs. Immature browner above, greyer below with less distinct markings.

Habitat. Inhabits scrub vegetation including scrubby heath, fynbos and sheltered riverine scrub. Also exotic *Acacia* stands; will venture onto garden lawns where not persecuted.

Food and Feeding. Bulbs and coms, seeds, berries and shoots; also small molluscs, termites, ants and other insects.

Breeding. Lays Jul-Feb, with peak in Sept-Oct, late in winter rains or early in dry summer. Probably monogamous. Nest is a hollow lined with grass, well hidden under cover. Usually 6-8 eggs (mean of 25 clutches, 7-4); mean size of 45 broods was 4-2 chicks.

Movements. Sedentary. Flies only when hard pressed, preferring to escape by running.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Occurs in suitable habitat throughout c. 185,000 km². Locally common; numbers believed to be stable. Occurs in Cape Point and De Hoop Nature Reserves, which offer some protection, but are too small; whilst designation of further protected areas would be of benefit, such areas are probably not essential for long-term survival of species. Agricultural intensification may be a problem, as might overhunting.

Bibliography Clancey (1967, 1986), Crowe (1993), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Ginn *et al.* (1989), Hall (1963), Heyl (1988a, 1988b), Komen (1986, 1991b), Mackworth-Præd & Grant (1962), Maclean (1993), Schönwetter (1967), Urban *et al.* (1986).

46. Natal Francolin *Francolinus natalensis*

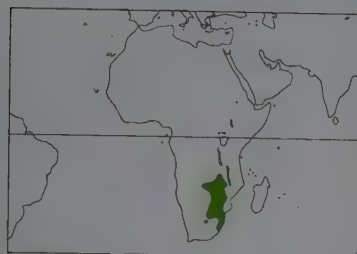
French: Francolin du Natal **German:** Natalfrankolin **Spanish:** Francolín de Natal

Taxonomy. *Francolinus Natalensis* A. Smith, 1834, Durban, Natal.

Forms superspecies with *F. hildebrandti*, with which occasional hybridization has been reported. Has at times been placed in genus *Chaetopus*, or alternatively in *Notocolinus*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Races proposed at various times, such as *neavei*, but variation clinal and validity of races not supported. Hybridizes with *F. swainsoni* in W Zimbabwe. Monotypic.

Distribution. C Zambia S through Zimbabwe and Swaziland to E South Africa (W Orange Free State, Natal, N & E Cape Province).

Descriptive notes. 30-38 cm; male 415-723 g, female 370-482 g. Differs from very similar male *F. hildebrandti* by finer, more regular black markings on underparts; from male *F. hartlaubi* by



red bill and feet; and from *F. clappertoni* by lack of distinct white supercilium. Female averages smaller, with much reduced spurs. Immature paler; underparts buff finely barred black, with white shaft streaks. Much geographical variation, with characters varying independently of each other: birds at centre of range paler than those to N and S.

Habitat. Usually occurs in habitats with some cover up to 1800 m, including hillsides littered with dense thickets, dry forest along water-courses and bush or woodland with undergrowth; even montane forest and bush. Also *Acacia* scrub in rocky country; amongst vegetation along rivers; and amidst mature crops on farmland.

Food and Feeding. Small bulbs and roots, cowpeas, berries and seeds, including grain; also beetles, termites, grasshoppers and caterpillars. Forages on rhinoceros and elephant dung.

Breeding. Probably breeds in late rains and winter across range as a whole; nesting unpredictable, usually Jan-Feb and Apr-Jul in South Africa; all months except Oct, especially Mar-May (over 50% of clutches) in Zimbabwe; Mar-May in Zambia. Probably monogamous. Nest is a scrape lined with grass in heavy cover. Usually 5 eggs (2-8); incubation in captivity 20 days, by female only; downy chicks have broad rufous brown central stripe above, creamy buff underparts.

Movements. Sedentary. Active early morning and late afternoon, moving to cover during midday heat. Slow flier, preferring to land in cover to evade raptors.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Occurs in suitable habitat throughout area of over 1,000,000 km². Considered generally abundant, locally common. In South Africa, numbers have declined due to land development, but are now considered stable, and sport hunting provides commercial incentive to conserve species: species occurs in several protected areas although its survival is not likely to depend upon such areas. In Zimbabwe, where hunting is permitted, a Aug-Nov shooting season is recommended. Not in need of conservation attention.

Bibliography. Benson (1963), Clancey (1967, 1986), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Ginn *et al.* (1989), Hall (1963), Harrap (1964), Hartley & Mundy (1992), Irwin (1971), Komen (1991b), Mackworth-Praed & Grant (1962), Maclean (1993), Urban *et al.* (1986).

47. Hildebrandt's Francolin

Francolinus hildebrandti

French: Francolin de Hildebrandt

Spanish: Francolín de Hildebrandt

German: Hildebrandtfrankolin

Taxonomy. *Francolinus hildebrandti* Cabanis, 1878, Voi, Taita district, Kenya.

Forms superspecies with *F. natalensis*, with which occasional hybridization has been reported. Has at times been placed in genus *Chaetopus*, or alternatively in *Notocolinus*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Proposed races, such as *johnstonii*, not valid, as variation is clinal. Monotypic.

Distribution. C & W Kenya S through Tanzania to SE Zaire (Musosa), NE Zambia and Malawi.



Descriptive notes. c. 34 cm; two males 600 g and 645 g, 2 females 430 g and 480 g. Male differs from very similar *F. natalensis* by less regularly patterned, more blotched underparts. Female has very distinctive rufous-buff underparts; in S of range, smaller and lacks white streaking on mantle. Immature more distinctly barred above than female.

Habitat. Open habitats with scattered cover between 2000 m and 2500 m; on rocky hillsides with dense scrub, thickets and bush grassland; low heath at higher altitudes.

Food and Feeding. Bulbs, tubers and seeds; also insects and their larvae.

Breeding. Lays in most months according to locality: Jul in Zambia; Apr-Nov (peak Jun-Jul) in Malawi; Jan, Mar, May-Aug and Nov-Dec in E Africa, apparently unrelated to rainfall. Probably monogamous. Nest is a well concealed scrape, lined with grass and leaves. Usually 6 eggs (4-8); downy chicks have broad rufous brown central stripe above, and buffy underparts.

Movements. Sedentary.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Occurs in suitable habitat throughout c. 1,200,000 km². In general, very locally distributed and uncommon. No further information available. Not considered to be in need of conservation attention, but detailed information on status and local abundance required.

Bibliography. Benson & Benson (1975), Britton (1980), Brown & Britton (1980), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Hall (1963), Jackson & Selator (1938), Komen (1991b), Lewis & Pomeroy (1989), Lippens & Wille (1976), Mackworth-Praed & Grant (1957-1973), Pomeroy & Abe (1992), Urban *et al.* (1986), Vincent (1934).

48. Yellow-necked Francolin

Francolinus leucoscepus

French: Francolin à cou jaune

German: Gelbkehlfrankolin

Spanish: Francolín Gorgiamarillo

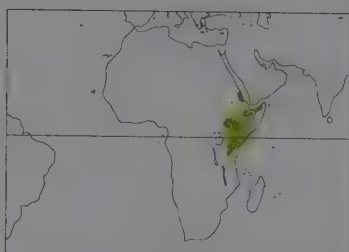
Other common names: Yellow-necked Spurfwol

Taxonomy. *Francolinus leucoscepus* G. R. Gray, 1867, Ethiopia.

Forms superspecies with *F. rufopictus*, *F. afer* and *F. swainsonii*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Various races proposed, but variation clinal and validity dubious; *infusatus* sometimes accepted. Hybridizes with *F. rufopictus* on edge of range in Tanzania. Monotypic.

Distribution. SE Sudan E through Ethiopia to Somalia, and S to NE Uganda, C Kenya and NC Tanzania.

Descriptive notes. c. 35 cm; male 615-896 g, female 400-615 g. Large francolin with orange-red bare skin around eye. Only francolin with bare yellow skin on throat and foreneck; large buff patch in primaries conspicuous in flight, black bill. Female averages smaller and has shorter spurs. Immature less distinctly marked.



Habitat. Inhabits both natural habitats and those altered by man, appearing to prefer *Acacia/Commiphora* bush with mixed annual and perennial grasses, and typically 200-400 mm of rain per year. Believed to be reasonably adaptable, and occurs in cultivation, including that sited in woodland, but only where human population fairly sparse.

Food and Feeding. In S Kenya and Tanzania, feeds predominantly on sedge tubers, especially *Cyperus rotundus*, which constitute over 50% by volume over year; fruits and seeds of herbs and grasses, mainly *Commelina*, *Cruciferae* and *Dryopteris*, 12.7% by volume over year; wide range of other plant matter of nearly 30 species, primarily seeds, amounting to 16.2%; also insects, 18.8%, mainly termites, 17.5%. During dry season, sedge tubers are main food, but these possibly drop to 7-18% by volume after rain, when grass and herb seeds become more important, and insects even more so until seeds have set. May also feed on fallen grain and legume crops around harvest time. Scratches loose ground with feet and eats food items exposed.

Breeding. Breeds late in rains if possible, so that hatching is in cool dry season. Nesting mainly May-Jul in Kenya and N Tanzania, but recorded in every month except Feb: Jan-Jun in Ethiopia; mainly Apr-Jun in Somalia. Monogamous and territorial during breeding season; rains are likely to stimulate breeding activity. Nest is a scrape, sometimes lined with grass, feathers, etc. In areas and times of low rainfall only a few pairs may form and no breeding may take place. Usually 5 eggs (3-8); incubation 18-20 days; downy chicks have dark brown broad central stripe above, buffy underparts. Chicks leave nest at c. 24 hours and stay with parents until adult size; at 4-6 weeks full set of juvenile primaries complete; spurs erupt around 18th week. Where there are two rainy seasons, family groups split at onset of following rains; where only 1 rainy season, may remain together until next breeding season. Many broods fail: average 4-3 chicks remain at 10-14 weeks; survival to adulthood probably less than 2 birds/pair/year.

Movements. Sedentary. In early morning may walk or fly hundreds of metres to particular areas, e.g. of crops, to feed. Follows elephants and rhinoceroses to forage on fresh droppings. When alarmed runs or flies to cover.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Occurs in suitable habitat throughout area of over 1,300,000 km². Considered frequent overall, but is common in some areas; in Kenya, densities of 81 birds/km² and 78 birds/km² recorded in suitable habitat at Selengei and Oluturo respectively, down to 2 birds/km² in wooded brushland; now extinct in extensive tracts of the country. Frequent to common in Ethiopia and Somalia. Numbers generally higher in cultivation; species can tolerate some human settlements, but retreats from densely populated areas. Decline in Kenya partly due to use of nylon in making snares for trapping; species easily trapped at edges of cultivation. Not in need of conservation attention, but extent of local extinctions should be monitored.

Bibliography. Archer & Godman (1937), Ash (1992), Ash & Mskell (1983), Britton (1980), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Hall (1963), Jackson & Selator (1938), Komen (1991b), Lack (1985), Lack *et al.* (1980), Lewis & Pomeroy (1989), Mackworth-Praed & Grant (1957), Pomeroy & Abe (1992), Redhead (1972), Snow (1978), Stronach (1966), Swank (1977), Urban *et al.* (1986).

49. Grey-breasted Francolin

Francolinus rufopictus

French: Francolin à poitrine grise

Spanish: Francolín del Victoria

German: Graubrustfrankolin

Other common names: Grey-breasted Spurfwol

Taxonomy. *Pternistis rufopictus* Reichenow, 1887, Wembere Steppe, Tanzania.

Forms superspecies with *F. leucoscepus*, *F. afer* and *F. swainsonii*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Local hybridization with *F. leucoscepus* has been reported. Monotypic.

Distribution. NW Tanzania, from L. Victoria to Serengeti and S to Wembere.



Descriptive notes. c. 35 cm; male 779-964 g, female 439-666 g. Differs from *F. leucoscepus* in reddish orange bill and bare skin on throat, and by chestnut on upperparts; from *F. afer* by black legs and generally paler plumage. Female averages smaller and has much shorter spurs. Immature much greyer above; underparts barred black and white.

Habitat. Inhabits plains and savannas in areas with rainfall of 500-700 mm, including edge of grassland and *Aeneia* woodland of, e.g. *A. tortilis*, *A. drepanolobium*, *A. xanthophylla* and *A. kirkii*; also in thickets along water-courses.

Food and Feeding. Feeds predominantly on predominantly *Cyperus* sedge tubers; also seeds and insects, e.g. grasshoppers and termites. Digs for tubers and also forages on seeds of weeds, legumes and cereals on farmland.

Breeding. Lays during late rains and dry season, in Feb-Apr and Jun-Jul. Monogamous and territorial. Nest is a depression amongst long grass, lined with grass and feathers. Usually 4-5 eggs; downy chicks have dark brown broad central stripe above, buffy underparts. Family groups usually number less than 7 individuals. Young remain with parents until following breeding season.

Movements. Sedentary. Moves into open to feed only in early morning and late afternoon.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Occurs in suitable habitat throughout c. 30,000 km². Considered a candidate for inclusion in Red Data Book in 1985. Restricted range; occurs in Serengeti Endemic Bird Area. Generally considered common, but only frequent in some areas. In St. Serengeti National Park hybridizes with *F. leucoscepus*, resulting in human population expands, causing concomitant spread from W into interior, and domestic stock grazing. Not believed to be in need of conservation attention, but detailed information should be gathered on status and abundance.

Bibliography. Britton (1980), Brown & Britton (1980), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Hall (1963), Komen (1991b), Mackworth-Praed & Grant (1957), Schmidt (1982), Turner (1977), Urban *et al.* (1986).

50. Red-necked Francolin

Francolinus afer

French: Francolin à gorge rouge **German:** Rotkehlfrankolin **Spanish:** Francolín Gorgirrojo
Other common names: Bare-throated Francolin, Red-necked Spurfowl; Cranch's Francolin (*cranchii*)

Taxonomy. *Tetrao afer* P. L. S. Müller, 1776, Benguela, Angola.

Forms superspecies with *F. leucoscepus*, *F. rufopictus* and *F. swainsonii*, although *F. swainsonii* sometimes excluded because of overlap with present species. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Several other races have been described, but doubtfully valid: *loangwae* included in *melanogaster*; and *intercedens* in *cranchii*; validity of several of the races currently accepted is also doubtful. Race *cranchii* (incorporating *leucoparaeus* and *harterti*) has been separated as distinct species. Nominate *afer* hybridizes with *F. swainsonii* near Harare, NE Zimbabwe. Seven subspecies currently recognized.

Subspecies and Distribution.

F. a. cranchii (Leach, 1818) - W Congo E to E Africa, around L Victoria, and S to NE Zambia.
F. a. harterti (Reichenow, 1909) - around N shore of L Tanganyika in Ruzizi Valley, Burundi, and NE Tanzania and E Zaire.

F. a. leucoparaeus Fischer & Reichenow, 1884 - Kenya, from R Tana to Tanzanian border.

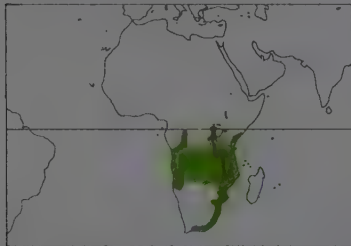
F. a. afer (P. L. S. Müller, 1776) - W Angola and extreme NW Namibia.

F. a. melanogaster (Neumann, 1898) - Mozambique (N of R Zambezi), E Tanzania and E Zambia.

F. a. swynnertoni (W. L. Sclater, 1921) - SE Zimbabwe E to C Mozambique (S of R Zambezi).

F. a. castaneiventris (Gunning & Roberts, 1911) - South Africa, from S & E Cape Province E to R Limpopo.

Introduced to Ascension I (S Atlantic).



Descriptive notes. c. 35 cm; male 480-907 g, female 370-652 g. Distinctive scarlet throat and red bill and legs, separate present species from *F. swainsonii* and *F. rufopictus*. Female averages smaller, with much shorter spurs. Immature appears duller and browner, with bill dark horn. Races separated by size, head pattern and underpart colouring: black and white (*afer*, *swynnertoni*, *melanogaster*, *leucoparaeus*), and vermiculated/rufous-striped (*castaneiventris*, *cranchii*, *harterti*) subspecies groups recognized; groups intergrade on two fronts, one from C Tanzania S through Malawi to E Zambia, and the other from NW Zimbabwe through to N & C Angola. Black and white group more variable and typified by heavily marked black and white underparts, and wing length usually over 18 cm, except in nominate *afer*; vermiculated/rufous-striped group characterized by vermiculated underparts, and wing length usually less than 18 cm.

Habitat. Wide range of brushy habitats, varying according to locality: in South Africa, wooded gorges and evergreen forest fringes; in Zambia, especially in damp grass and *Brachystegia* and mopane woodland; in Zimbabwe, thickets and moist vegetation; in Zaire and Uganda, grassland littered with thickets; in Tanzania, grassland with trees and bushes; on Kenyan coast, forest interspersed with grassland. Where sympatric with other francolins, especially *F. swainsonii* and *F. leucoscepus*, occurs in denser, more moist vegetation, mainly along watercourses.

Food and Feeding. Diet varies with season and locality: in Zaire, mainly small tubers; in S Africa, mostly vegetable matter (tubers, roots and bulbs, shoots, berries and fruit, and fallen crops) and some insects and their larvae, including termites on the wing; in Zimbabwe, invertebrates, grass shoots and seeds during warm and wet months, switching to seeds and underground bulbs and roots in cool, dry months. Will take ticks off grass stalks.

Breeding. Mostly lays late in rains, with chicks emerging amongst dense cover of early dry season: lays cool dry season, Apr-Aug, in E South Africa; wet and dry seasons, Jan-Jul (mainly Apr) and Nov-Dec (mainly Dec), in Zimbabwe; Mar-Jun in Angola; Nov-Jul in Zambia; Jan-Aug in Malawi; most months, but depending on locality, in E Africa. Monogamous and territorial. Male defends area around nest, chasing off other males. Nest is a hollow on ground made by female, often partly lined with grass, feathers or similar material, in long grass at base of tree or bush. Usually 3-9 eggs; incubation in captivity 23 days, eggs hatching synchronously; downy chicks have broad blackish central stripe above, yellow-buff below with some black; pin feathers emerge within 2 days, wing feathers at 4 days, flight at 10 days, sibling aggression at 39 days; chicks nearly fully-grown at 3-4 months. May breed at one year old, when family groups dissolve.

Movements. Sedentary. Flies only short distances of 50-100 m, and only when pressed, preferring to run into cover.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Occurs in suitable habitat throughout c. 5,000,000 km². Generally common to abundant, with densities of 34-44 birds/km² reported from sites in Queen Elizabeth and Lake Mburo National Park, Uganda; possibly over 1,000,000 birds in South Africa; known to have declined near Harare, NE Zimbabwe, and in Zaire.

Shooting season should be restricted to Aug-Nov in Zimbabwe, where species confined to Mashonaland Plateau in Eastern Districts. Otherwise not in need of conservation attention.

Bibliography. Abe (1993), Baker (1981), Bannerman (1953), Benson (1963), Benson & Benson (1975), Britton (1980), Chapin (1932), Clancey (1967), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Ginn *et al.* (1989), Hall (1963), Hartley & Mundy (1992), Irwin (1971), Jackson & Sclater (1938), Komen (1991b), Lewis & Pomeroy (1989), Mackworth-Præd & Grant (1957-1973), Maclean (1993), Peek (1972), Pinto (1983), Pomeroy & Abe (1992), Roles (1973), Snow (1978), Urban *et al.* (1986), Verschuren & Mankarika (1982), Vincent (1934).

51. Swainson's Francolin

Francolinus swainsonii

French: Francolin de Swainson **German:** Swainsonfrankolin **Spanish:** Francolín de Swainson
Other common names: Swainson's Spurfowl

Taxonomy. *Perdix Swainsonii* A. Smith, 1836, Kurrichane, western Transvaal.

Forms superspecies with *F. leucoscepus*, *F. rufopictus* and *F. afer*, although present species sometimes excluded because of overlap with *F. afer*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Several other races have been described, but doubtfully valid: *damarensis*, *gilli* and *chobiensis* all included in nominate *swainsonii*. Hybridizes with *F. afer* near Harare, NE Zimbabwe, and with *F. natalensis* in Bulawayo, SW Zimbabwe. Two subspecies recognized.

Subspecies and Distribution.

F. s. lundazi C. M. N. White, 1947 - N & W Zimbabwe and S Mozambique.

F. s. swainsonii (A. Smith, 1836) - SE Angola, N Namibia and N Zambia S to NE South Africa (N Natal, Transvaal).



Descriptive notes. Male c. 38 cm, female c. 33 cm; male 400-875 g, female 340-750 g. Black upper mandible and legs prevent confusion with *F. afer* and other bare-throated francolins. Female smaller, darker and more heavily patterned than male; spurs much reduced. Immature paler and duller. Races are considered rather poorly defined: populations in N Namibia, Botswana and W Zimbabwe vary locally and have characters resembling both of accepted races; those of Namibia and Botswana more closely resemble *swainsonii*, while those of Zimbabwe seem closer to *lundazi*; race *lundazi* smaller and paler.

Habitat. Savanna and bush, not far from water: prefers dense grassland near grain fields and water, but also found in country with good cover; sometimes at forest edge or in forest, and especially in grass along watercourses. In South Africa, occurs especially in dense grassland close to water and farmland; in Zimbabwe, favours thickets at forest edge and along streams. More dependant on water than most other African francolins.

Food and Feeding. Bulbs, tubers and roots, seeds, berries and grass leaves, together with some spiders and insects, including locusts, ticks, beetles and grasshoppers, and small molluscs. Grain crops also taken, especially fresh maize sprouts. In Transvaal: 30% maize, wheat and beans and other crops; 25% seeds of native plants, mainly pioneer grasses such as *Urochloa*, *Eleusine*, *Panicum* and *Digitaria*, as well as *Juncus* and *Concorus*; 14% roots and corns, predominantly *Cyperus*; 7% arthropods; and 2% green leaves. In summer arthropods constitute up to 20% of crop weight; in winter and spring feeds mostly on cultivated crops. Feeds and drinks in early morning and late afternoon.

Breeding. Lays in all months depending on locality: in South Africa Dec-May, sometimes any month, or even twice in one year; during at least part of period Feb-May in Swaziland, Botswana and Namibia; Nov-Aug (mainly Feb-Mar) in Zimbabwe; recorded at various times of year in Mozambique; May-Jul and Dec in Zambia. Monogamous and territorial. Nest is a hollow on ground lined with grass, leaves and similar material, concealed amongst cover. Usually 4-8 eggs; incubation c. 21 days; downy chicks have dark, rich brown broad central stripe above, and buffy underparts. Survival rate believed to be high, with mean of c. 6 chicks in broods in Transvaal.

Movements. Sedentary. Prefers to escape predators by running, but is a fast flier and can avoid raptors when on the wing.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Occurs in suitable habitat throughout c. 1,500,000 km². Generally common to abundant over much of range. Possibly over 1,000,000 birds in South Africa where numbers are stable and range increasing; occurs in several protected areas, but likely to survive outside such areas without special protection. Moves into cultivation and has even displaced *F. afer* in farmland around Harare, NE Zimbabwe. During 1972 season, c. 6700 individuals were shot in Zimbabwe; recommendation that shooting should now be restricted to period Aug-Nov. Otherwise not in need of conservation attention.

Bibliography. Benkenstein (1975), Benson (1963), Benson & Benson (1975), Cardwell (1971), Clancey (1967), Crowe & Crowe (1985), Crowe *et al.* (1992), Ginn *et al.* (1989), Hall (1963), Hartley & Mundy (1992), Irwin (1971), Komen (1991b), Kruger (1981), Mackworth-Præd & Grant (1962), Maclean (1993), Mentis (1970), van Niekerk (1983), Peek (1972), Pinto (1983), Urban *et al.* (1986).

inches 8
cm 20

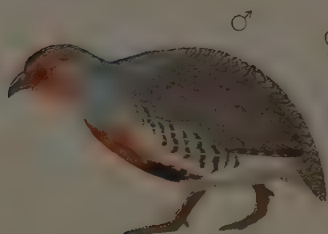
PLATE 47



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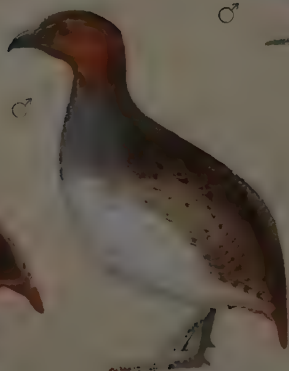
ssp. castaneicollis



ssp. dulitensis



ssp. longirostris



52. Jackson's Francolin

Francolinus jacksoni

French: Francolin de Jackson German: Jacksonfrankolin Spanish: Francolín de Jackson

Taxonomy. *Francolinus jacksoni* Ogilvie-Grant, 1891, Kikuyu, Kenya.

Forms superspecies with *F. erckelii*, *F. ochropectus*, *F. castaneicollis* and *F. nobilis*. Has been separated in genus *Oreocolinus*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Birds of Mt Kenya have been ascribed to race *pollenorum* and those of the Cherangani Hills to race *patriciae*, but neither of these races is generally accepted. Monotypic.

Distribution. Mountains of WC Kenya.



Descriptive notes. c. 38 cm; two males 1064 g and 1130 g. Differs from *F. castaneicollis* in more regularly patterned underparts and little or no blackish colouring on forehead and face. Female averages smaller than male, with much reduced spurs. Immature duller above and barred. Individuals of Mt Kenya are somewhat darker than birds in W.

Habitat. Montane forest and various habitats in alpine zone from 2200 m to 3700 m, including juniper and bamboo forest and moorland thickets; typically found in *Juniperus*, *Podocarpus*, *Hagenia* and *Hypericum* forest, *Arundinaria alpina* bamboo, and moorland

Erica and *Stoebe* thickets. Not usually within forest, but typically in thick shrub cover, and especially abundant in heath, e.g. plentiful in giant heath in Aberdare Range, and where scrub has replaced dead bamboo. Does venture into open patches, such as those of short Kikuyu grass, and also onto roadside verges in some places.

Food and Feeding. Bulbous roots and grass shoots, berries when available and small snails and insects; seeds in patches of dying bamboo. In dry weather emerges to feed before sunrise, and will feed throughout day.

Breeding. Lays Dec-Jan in Aberdare Range and on Mt Kenya; Jan-Feb, Aug, Oct and Dec in Mau Highlands; in high, wet ranges, may breed only during dry season. Monogamous and territorial. One nest found by bamboo clump, but structure undescribed. At least 3 eggs; up to 7 chicks seen in a brood, which stays with adult for about c. 8 months.

Movements. Sedentary. Moves out into open areas to dry plumage and dust-bathe during suitable weather.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Occurs in suitable habitat throughout c. 50,000-60,000 km². Considered a candidate for inclusion in Red Data Book in 1985. Restricted range; occurs in Kenyan Mountains Endemic Bird Area. Locally common to abundant, at high densities in national parks; c. 900 km² of Mt Elgon Forest Reserve is at appropriate altitude. Species approaches humans quite closely in Aberdare National Park. Lower fringes of forest are disturbed, but species not in need of conservation attention at present. More detailed information on distribution and abundance required.

Bibliography. Betts (1966), Britton (1980), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Hall (1963), Hall & Moreau (1962), Jackson & Slater (1938), Komen (1991b), Lewis & Pomeroy (1989), Mackworth-Præd & Grant (1957), Ripley & Bond (1971), Sessions (1967), Snow (1978), Turner (1977), Urban *et al.* (1986).

53. Handsome Francolin

Francolinus nobilis

French: Francolin noble German: Edelfrankolin Spanish: Francolín Noble

Taxonomy. *Francolinus nobilis* Reichenow, 1908, Virunga Volcanoes, Zaire.

Forms superspecies with *F. jacksoni*, *F. erckelii*, *F. ochropectus* and *F. castaneicollis*. Has been separated in genus *Oreocolinus*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Birds of Ruwenzori Mts have been ascribed to race *chapini*, but this race not generally accepted. Monotypic.

Distribution. SW Uganda, Rwanda and Burundi to mountains of E Zaire.



Descriptive notes. c. 34 cm; two males 862 and 895 g, female 600-670 g. Distinctive combination of red bare parts, including patch of bare skin around eye, and dark rufous on most of underparts. Female smaller than male and somewhat duller, with much reduced spurs. Immature differs in having barred upperparts and rather paler underparts. Individuals from Ruwenzori Mts have belly feathers with narrower grey edges, a character which varies within populations elsewhere.

Habitat. Occurs from lower edge of montane forest, through areas of bamboo to alpine heath at c. 3700 m.

Food and Feeding. Feeds on seeds. Forages along roads in very early morning and late afternoon. Breeding. Laying from late Apr to Sept in S Kivu Province, E Zaire. Small groups have been seen, which were assumed to be family parties. No further information available.

Movements. Sedentary. Flies short distances and only when hard pressed, preferring to escape by running into cover.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Occurs in suitable habitat throughout c. 130,000 km². A candidate for inclusion in Red Data Book in 1985. Considered to be generally common to locally abundant. In Uganda probably restricted to three national parks, but two of these contain areas of only 45 km² and 80 km² at suitable altitude; protected areas generally effective and maintenance of these is necessary for long-term survival. Not in need of

immediate conservation attention, but much more detailed information required on distribution and relative abundance.

Bibliography. Britton (1980), Chapin (1932), Crowe (1993), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Grant & Mackworth-Præd (1935), Hall (1963), Komen (1991b), Lappens & Wille (1976), Mackworth-Præd & Grant (1957, 1970), Pitman (1948), Prigogine (1971), Urban *et al.* (1986).

54. Mount Cameroon Francolin

Francolinus camerunensis

French: Francolin du Cameroun German: Kamerunfrankolin Spanish: Francolín del Camerún
Other common names: Cameroon Mountain/Cameroon Francolin

Taxonomy. *Francolinus camerunensis* Alexander, 1909 Mount Cameroon.

Forms superspecies with *F. swierstrai*. Has been separated in genus *Oreocolinus*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Monotypic.

Distribution. Slopes of Mt Cameroon (W Cameroon).



Descriptive notes. c. 33 cm; male c. 593 g, female c. 509 g. Distinguished from rather similar *F. nobilis* by more extensive dark brown above and lack of chestnut or pale grey patterning on underparts. Female has distinctive appearance, with peculiar combination of red bare parts, barred upperparts and streaked and vermiculated underparts. Immature resembles adult female but is barred below, and has bill and legs dull red.

Habitat. Found in both primary and secondary forest where there is dense undergrowth. Occurs between 850 m and 2100 m in montane forest; seems to avoid montane grassland

on upper slopes of Mt Cameroon.

Food and Feeding. Berries, grass seeds and insects.

Breeding. Breeds during the dry season, with birds laying between Oct and Dec. No further information available.

Movements. Sedentary. Will fly to trees to escape dogs, but otherwise runs when alarmed.

Status and Conservation. RARE Mace-Lande: Vulnerable. Restricted to 200 km² on SE & NE slopes of Mt Cameroon. Originally collected from above Musaka and then from above Buea, both on SE slopes of mountain; heard from SW slopes above Isongo in 1938; birds seen and heard on a few occasions above Buea since 1970, especially during survey work in early 1980's, and also on NE slopes at the same time. Said to be locally common, especially on S slopes of mountain, where appears to be common down to 850 m. No evidence of marked population decline: much of forest on Mt Cameroon has suffered damage, but species appears to be able to tolerate secondary forest; access to mountain is controlled to some extent in places. Restricted range; occurs in Cameroon Mountains Endemic Bird Area. In 1982 a large area of suitable habitat in this very small range was destroyed by a volcanic eruption. Species may also be overhunted. Surveys should attempt to determine requirements and assess feasibility of habitat protection.

Bibliography. Alexander (1909), Bannerman (1915, 1930, 1953), Boulton & Rand (1952), Collar & Andrew (1988), Collar & Stuart (1985), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Eisenstat (1956, 1963), Grimes (1971), Hall (1963), Jensen & Stuart (1985), Komen (1991b), Louette (1981), Mackworth-Præd & Grant (1970), Serle (1962, 1965, 1981), Stuart & Jensen (1986), Urban *et al.* (1986)

55. Swierstra's Francolin

Francolinus swierstrai

French: Francolin de Swierstra German: Swierstrafrankolin Spanish: Francolín de Swierstra

Taxonomy. *Chaetopus swierstrai* Roberts, 1929, Mombolo, south-west Cuanza Sul, Angola.

Forms superspecies with *F. camerunensis*. Has been separated in genus *Oreocolinus*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. *F. cruzi* is a synonym. Monotypic.

Distribution. W Angola, from Cuanza Sul District to Huila District.



Descriptive notes. c. 33 cm; male c. 600 g, female c. 560 g. Diagnostic broad black band on breast. Female has some buff streaking on upperparts, and much reduced spurs. Immature resembles female with barred belly and more buff above.

Habitat. Montane evergreen forest and forest edge, boulder strewn mountain sides, and tall grass on mountain tops and in gullies. In forest stays within dense undergrowth of bushes, shrubs, grasses and large ferns. Dependence on forest not clear.

Food and Feeding. Grasses, legume seeds and insects, picked from amongst leaf litter.

Breeding. Virtually unknown; believed to breed May-Jul, based on gonadal development of specimens.

Movements. Sedentary.

Status and Conservation. INDETERMINATE Mace-Lande: Vulnerable. CITES II. Has restricted range and is apparently rare within it. A few remnant forest blocks still persist on e.g. Mt Moco and Mt Soque. Probably declining in view of habitat destruction that is in progress. If dependent on forest to a large degree, species is likely to be seriously threatened by loss of this habitat, much of which has already disappeared: a few km² in the Bailundu Highlands and on the scarp may have been all that remained in 1962; since then, a population was found to N. at E. Angango, but extent of habitat available to species probably very small. Occurs in Angola Endemic

On following pages: 56. Chestnut-naped Francolin (*Francolinus castaneicollis*); 57. Erckel's Francolin (*Francolinus erckelii*); 58. Umbou Francolin (*Francolinus ochropectus*); 59. Grey Partridge (*Perdix perdix*); 60. Daorian Partridge (*Perdix dauirica*); 61. Tibetan Partridge (*Perdix hodgsoniae*); 62. Long-billed Partridge (*Rhizothera longirostris*); 63. Madagascar Partridge (*Margaroperdix madagarensis*); 64. Black Wood-partridge (*Melanoperdix nigra*).

Bird Area. Some conservation work is under way, but details are lacking. An extensive survey is needed to identify status, threats and propose actions for habitat protection.

Bibliography. Collar & Andrew (1988), Collar & Stuart (1985, 1988a), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Hall (1960a, 1963), Hall & Moreau (1962), Heinrich (1958), King (1978/79), Komen (1991b), Pinto (1970, 1983), Roberts (1929), Themido (1937), Traylor (1960a, 1960b, 1963), Urban *et al.* (1986), White (1945).

56. Chestnut-naped Francolin

Francolinus castaneicollis

French: Francolin à cou roux

Spanish: Francolín Cuellicastaño

German: Braunnackenfrankolin

Other common names: Ethiopian Francolin (*atrifrons*)

Taxonomy. *Francolinus castaneicollis* Salvadori, 1888, Lake Ciar-Ciar (= Chercher), Hararghe, Ethiopia.

Forms superspecies with *F. jacksoni*, *F. nobilis*, *F. erckelii* and *F. ochropectus*. Has been separated in genus *Oreocolinus*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Several other races have been described, but validity doubtful; *bottegi*, *ogonensis*, *kaffanus*, and *gofanus* all included in nominate *castaneicollis*. Race *atrifrons* has been considered to be specifically distinct. Two subspecies recognized.

Subspecies and Distribution.

F. c. castaneicollis Salvadori, 1888 - Ethiopia and Somalia.

F. c. atrifrons Conover, 1930 - S Ethiopia and extreme N Kenya.



Descriptive notes. c. 33-5 cm; male 915-1200 g, female 550-650 g. Black forehead and creamy white belly separate from otherwise rather similar *F. jacksoni*; from *F. erckelii* and *F. ochropectus* differs by red bill and legs, and by underpart pattern. Female averages smaller than male, with much reduced spurs. Immature duller. Variation is clinal, with birds from Somalia paler than those from NE Ethiopia, while those from Jimma and Kaffa Provinces are richer chestnut; race *atrifrons* lacks chestnut on breast and upperparts and distinct markings on belly of *castaneicollis*.

Habitat. Forest, glades and undergrowth, altitude limits appearing to vary with locality. Recorded between 1200 m and 2250 m in arid juniper forest in Bale and Arussi Mts of Ethiopia; along edges of broad-leaved forest in Kaffa and Jima Provinces. Optimum habitat considered to be *Hagenia/Hypericum* forest with wet, dense undergrowth of red-hot poker lilies (*Knifophia*) and giant *LOBELIA*, at 3100-3500 m.

Food and Feeding. Seeds and insects such as termites. Forages in coveys, picking food from ground, or taking it from plant heads, rather than by digging. Rarely forages in fields, but may take fallen grain in some areas. Will feed throughout day, especially in morning and evening.

Breeding. Lays Oct-Mar in Ethiopia; May (wet season) and Dec (dry season) in Somalia. Probably monogamous. Nest is a depression under cover. Usually 5-6 eggs. Young stay with parents until fully-grown; family parties of 5-8 suggest that breeding success may be high.

Movements. Sedentary.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Occurs in suitable habitat throughout range of c. 270,000 km². Generally common to abundant, but superabundant in Bale and Arussi Mts in Ethiopia; more common to E of Rift Valley than to W; less common in Somalia. Probably stable in Ethiopia; trend in Somalia not known, but widespread habitat degradation continues. Not in need of conservation attention.

Bibliography. Ash (1992), Ash & McKell (1983), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Hall (1963), Komen (1991b), Lewis & Pomeroy (1989), Mackworth-Præd & Grant (1957), Raethel (1988), Urban *et al.* (1986).

57. Erckel's Francolin

Francolinus erckelii

French: Francolin d'Erckel

German: Erckelfrankolin

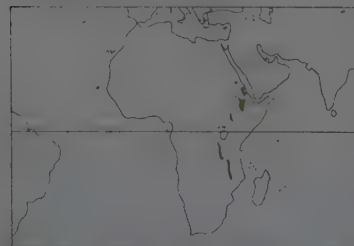
Spanish: Francolín de Erckel

Taxonomy. *Perdix erckelii* Rüppell, 1835, Taranta Mountains, Ethiopia.

Forms superspecies with *F. jacksoni*, *F. nobilis*, *F. castaneicollis* and *F. ochropectus*. Has been separated in genus *Oreocolinus*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Proposed race *pentoni* not considered valid. Monotypic.

Distribution. N Ethiopia, including Eritrea; also Red Sea Province, Sudan.

Introduced to Hawaii.



Descriptive notes. 39-43 cm; 1050-1590 g. Very large size; upperparts more olive brown overall than in similar *F. ochropectus*; black bill and yellowish legs prevent confusion with *F. castaneicollis*. Female smaller, with much reduced spurs. Immature barred and streaked on paler grey upperparts. Isolated population in Sudan is paler.

Habitat. Blocks of scrub, consisting of *Carissa*, *Rumex*, *Maytenus* and *Rosa abyssinica*; forest remnants with tall *Hyparrhenia* grass on hills between 2000 m and 3500 m; also *Erica arborea* heath in higher mountains and woods, along stream beds; much lower in

Sudan than in Ethiopia. Tends to remain at forest edge when tall forest available.

Food and Feeding. Seeds, shoots and berries, and some insects. Forages in scrub, at forest edge and in cultivation; feeds on sheer cliffs by flying from ledge to ledge.

Breeding. Lays in May and Sept-Nov, during rains; in Ethiopia; and Apr-May, during rains, in N Sudan. Probably monogamous. Nest is a scrape on the ground. Usually 4-10 eggs; chicks have dark brown and black down above, brownish white below. Both parents stay with young; young birds known to suffer predation by baboons.

Movements. Sedentary. Runs uphill when alarmed; if pursued, flies back downhill.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Occurs in suitable habitat throughout c. 220,000 km². Considered common and now probably stable in Ethiopia, although may be less widespread than in past, as many of forests in N have been destroyed. No information available regarding status of isolated population of Sudan. Not in need of conservation attention, but more detailed information required on distribution and relative abundance.

Bibliography. Ash (1992), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Hall (1963), Komen (1991b), Lever (1987), Mackworth-Præd & Grant (1957), Moltoni & Ruscone (1940-1944), Nikolaus (1987), Raethel (1988), Urban *et al.* (1986).

58. Djibouti Francolin

Francolinus ochropectus

French: Francolin somali

German: Wacholderfrankolin

Spanish: Francolín Somali

Other common names: Ochre-breasted/Tadjoura/Pale-bellied Francolin

Taxonomy. *Francolinus ochropectus* Dorst and Jouanin, 1952, Plateau du Day, Tadjoura, Djibouti. Forms superspecies with *F. jacksoni*, *F. nobilis*, *F. castaneicollis* and *F. erckelii*. Has been separated in genus *Oreocolinus*. Recently proposed reorganization of *Francolinus* places present species in genus *Pternistis* with 23 other species. Considered a weakly differentiated species, intermediate geographically and morphologically between *F. erckelii* and *F. castaneicollis*. Monotypic.

Distribution. Forêt du Day in Goda Mts and Maba Mts of Djibouti.



Descriptive notes. c. 33 cm; c. 940 g. Smaller and darker above than *F. erckelii*; black bill and yellow legs separate from *F. castaneicollis*. Female smaller than male, with more rufous in tail, and spurs much reduced. Immature resembles female, but is barred buff and grey.

Habitat. Occurs in c. 1500 ha of primary juniper forest above 700 m; main plant species are *Juniperus procera*, which may grow to 8 m tall, and *Buxus hildebrandtii* and *Clusia abyssinica* which make up the understorey. Elsewhere associated with *Ficus*, *Acacia seyal* and *A. etbaica*. Also found in secondary forest

and may occur in degraded habitat.

Food and Feeding. Seeds, berries and termites. Also feeds on figs at forest edge, where a parasitic *Ficus* occurs. When searching for food, rakes over ground, including areas disturbed by warthogs.

Breeding. Laying in Dec-Feb; family of 9 individuals seen in Mar, a period when genets (*Genetta genetta*) are major predators. No further information available.

Movements. Sedentary.

Status and Conservation. ENDANGERED. Mace-Lande: Endangered. Very limited range, with 3500 ha of habitat known at 2 sites; there is a slight possibility of species occurring elsewhere; available habitat was halved between 1977 and 1983. Main site is Forêt du Day, which is now c. 1400-1500 ha in extent, within area of c. 100 km² which have been designated a national park. Range is in zone affected by war at present. Probably fewer than 1000 birds survive, although there were possibly 5000 in 1986, so a decline is inferred. Threatened by habitat degradation through grazing and firewood collection; also by overexploitation, with eggs and some birds taken for food, although extent unknown. Designation of Maba Mts as a protected area is desirable, in conjunction with appropriate management and environmental education; protection of existing Forêt du Day National Park should be improved. As numbers are so low, and believed to be concentrated in two sites, an extensive survey of all known and possible localities within range should be conducted, to try to assess exact numbers; research into ecological requirements is also necessary, in order to guide management strategies; a Population and Habitat Viability Assessment is needed, to clarify conservation management options.

Bibliography. Ash (1992), Blot (1985), Collar & Andrew (1988), Collar & Stuart (1985), Crowe & Crowe (1985), Crowe & Kemp (1986), Crowe *et al.* (1992), Dorst & Jouanin (1952, 1954), Hall (1963), Hall & Moreau (1962), King (1978/79), Komen (1991b), Laurent (1990), Urban *et al.* (1986), Welch & Welch (1984, 1985, 1986), Welch *et al.* (1986).

Genus PERDIX: Brisson, 1760

59. Grey Partridge

Perdix perdix

French: Perdrix grise

German: Rebhuhn

Spanish: Perdiz Pardilla

Other common names: Common Partridge

Taxonomy. *Tetrao Perdix* Linnaeus 1758, Europe = Sweden.

Internal taxonomy needs revision. Proposed race *italica* normally included within nominate *perdix*. Seven subspecies currently recognized.

Subspecies and Distribution.

P. p. hispaniensis Reichenow, 1892 - NE Portugal and N Spain.

P. p. amurica Hartert, 1917 - Normandy and C France N to Ardennes and Morvan Mts.

P. p. sphagnetorum (Altum, 1894) - NE Netherlands and NW Germany.

P. p. perdix (Linnaeus, 1758) - British Is and Scandinavia to Alps and Balkans.

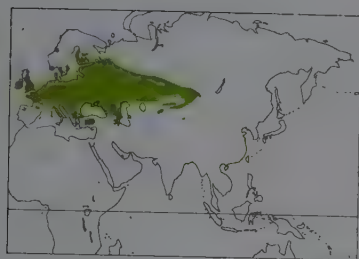
P. p. lucida (Altum, 1894) - Finland E to Ural Mts and S to Black Sea and N Caucasus.

P. p. canescens Buterlin, 1906 - Turkey, Caucasus, Transcaucasia and Iran.

P. p. robusta Homeyer & Tancré, 1883 - basin of lower R Ural E through Kazakhstan to SW Siberia and NW China (Xinjiang).

Introduced and reintroduced to many parts of Europe, including Finland, Britain, Russia and France; also successfully introduced to USA and Canada.

Descriptive notes. 29-31 cm; 310-455 g; wingspan 45-48 cm. Very variable, especially in terms of greyer or browner plumage. Distinguished from very similar *P. daurica* by darker, browner plumage and grey breast without extensive orange cinnamon tinge. Chestnut patch on breast may be absent in female; female slightly darker in summer. Immature has broader bars on wing and



browner legs. Considerable individual variation within each race, but races in W usually more rufous brown, those in E generally paler and greyer.

Habitat. Grassland in temperate zone, steppe regions and open arable landscapes. Typically found in large tracts of grassland, or in other ground cover that is only slightly taller than the bird itself, with some dense shrubby patches, e.g. hedgerows, at intervals. Seeks proximity of ploughed fields, dunes and other kinds of open area. Much of species' original habitat is now under agriculture, but it appears to be reasonably adaptable to some less in-

tensive practices.

Food and Feeding. Feeds on seeds of grains and weeds, cereals and clover, and grass leaves; insects such as Coleoptera, aphids and bugs. Studies in many countries show that in autumn food consists mainly of green leaves of grasses (Gramineae), cereals and clover (e.g. *Trifolium*) and grain and weed seeds (especially *Polygonum*). In spring and summer, seed heads of chickweed (*Stellaria*) and unripe grass seeds are preferred in Britain. Proportion of weed seeds in autumn diet dropped from 31% (by dry weight) in 1933-1936 to 4% in 1968-1977; this drop attributed to use of herbicides and change in stubble removal practices. Chicks dependent on insects in first 2 weeks of life; proportion in diet varies between studies, but at least half volume of intake. Insects eaten include larvae of sawflies which eat cereal leaves, Hemiptera, Heteroptera and other larger bugs, various beetles, and cereal aphids.

Breeding. Laying from late Apr in Britain; early May to Jun in C Europe; and late May to June in Sweden; reneesting until Aug-Sept. Usually monogamous, but in some cases male with 2 females for up to 2 weeks; pairing up to 4 months before breeding, with changes of mate common during that period; pairs may reunite in following breeding season. Territorial, but boundaries not defended; copulation, nesting and some feeding all within territory; after chicks hatch, territories break up. Nest is a shallow depression lined with leaves and grass, at base of hedge or in other thick vegetation. First clutch 15-17 eggs (4-24); clutch smaller when reneesting; incubation 23-25 days, usually by female alone; downy chicks have rufous, chestnut and black markings on buff upperparts, creamy yellow underparts; capable of precocial flight after c. 2 weeks; adult weight at c. 100 days. Chick survival to 6 weeks very variable. Sexual maturity in first year.

Movements. Mainly sedentary, but in E Europe is partially migratory, and nomadic in bad weather. Performs altitudinal movements in Caucasus, descending to foothills in Oct-Nov. Flight is fast and strong, but usually for no more than 2 km. In British Is, little movement in winter; coveys disperse locally in early spring.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Considered safe because still widespread and estimated to number several million birds. However, numbers have declined markedly in all parts of its native range for which bag records exist; since early part of present century, may have declined in all c. 31 countries in which it is found. Reduction in numbers believed to be as high as 80%; causes probably include factors such as loss of nesting cover, predation, and pesticides that reduce insect abundance in spring; all are consequences of intensification of agricultural practices. Specific recommendations to address these problems include: provision of good quality nesting cover; reduction of nest predation by controlling impact of foxes, stoats and feral cats; improving insect abundance in spring so that chicks have sufficient prey items.

Bibliography. Aebischer (1991), Beani & Dessì-Fulgheri (1986), Beani, Cervo & Dessì-Fulgheri (1988), Beani, Cervo, Lodi *et al.* (1988, 1992), Birkan (1971), Birkan & Jacob (1988), Birkan & Serre (1988), Birkan *et al.* (1992), Blank & Ash (1956, 1960), Blank *et al.* (1967), Carroll (1993), Cheng Tso-hin (1987), Church *et al.* (1990), Cramp & Simmons (1980), Dementiev & Gladkov (1952), Dessì Fulgheri *et al.* (1986, 1990), Dowell (1988, 1990), Dudzinski (1992), Etchécopar & Hùe (1978), Flint *et al.* (1984), Gossow *et al.* (1992), Illner (1992), Jenkins (1961), Jonsson (1992), Kavanagh (1992), King (1978/79), Kuz'mina (1992), Lever (1987), Lupo *et al.* (1990), Marchant *et al.* (1990), Nikiforov (1992), Novoa (1992a, 1992b), Panek (1987), Patrikeev (1993), Pielowski (1988), Potapov & Flint (1989), Potts (1986), Pulliainen (1984), Rands & Hayward (1987), Rasmussen *et al.* (1989), Reitz (1989, 1992), Reitz *et al.* (1984), Simeonov *et al.* (1990).

60. Daurian Partridge

Perdix dauurica

French: Perdrix de Daourie

German: Bartbrebhuhn

Spanish: Perdiz Daurica

Taxonomy. *Tetrao perdix* var. *dauurica* Pallas, 1811, Transbaikalia.

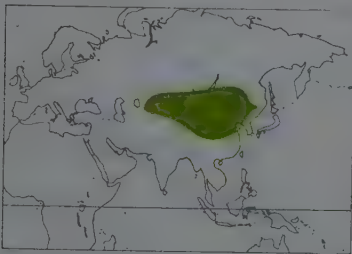
Sometimes erroneously spelt *P. dauuricae*. Formerly known as *P. barbata*. Proposed race *przewalski* included within race *suschkini*. Two subspecies recognized.

Subspecies and Distribution.

P. d. dauurica (Pallas, 1811) - Kirghizia and W China (Xinjiang) E to Mongolia and E Russia, S to Tuva Mts.

P. d. suschkini Poliakov, 1915 - C & NE China (Qinghai E to Heilongjiang).

Introduced and established around Manila (N Philippines).



Descriptive notes. c. 30 cm; 200-340 g. "Beard" of stiff feathers on sides of chin distinctive in autumn and winter. Differs from very similar *P. perdix* by paler and greyer plumage, less reddish face, extensive cinnamon patch on breast, and larger (male) and blacker patch on belly. Female more barred and vermiculated than male, with belly patch reduced or absent. Immature more coarsely marked above. Races similar.

Habitat. Variety of open habitats from grassland and meadows to wooded steppes and plantations; up to 3000 m in steppe regions of former USSR.

Food and Feeding. Very little information available. Takes seeds of weeds, cereals and berries; also insects in summer.

Breeding. Nesting from late May in Jilin and Shanxi (NE & NC China); pairing begins by mid-Mar in Altai region, where laying begins in late Apr. Nest is situated in or next to cover and lined with grass, leaves, roots and soft feathers. 35 clutches contained 18-20 eggs (minimum 12); incubation c. 25 days, by female only.

Movements. No information available, but some seasonal movements suspected in response to weather conditions.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Considered safe from extinction largely because of extensive range. In NE China considered common in Jilin, Hebei and Heilongjiang; in Jilin, numbers believed to be decreasing due to overhunting; average of 4-2 individuals were encountered along 3 km line transect in 1982 and 2-7 birds in 1990; little information from other parts of China, but hunters report decline in bags in Shanxi (NC China). In Transbaikalia, population size believed to have varied considerably over period of only a few years. Whilst population trends are unclear, species appears to be hunted throughout much of its range; monitoring of numbers shot in several areas throughout range would help to clarify status.

Bibliography. Cheng Tso-hin (1987), Cheng Tso-hin *et al.* (1978), Dementiev & Gladkov (1952), Dickinson *et al.* (1991), Etchécopar & Hùe (1978), Flint *et al.* (1984), Guo Ling (1987), Johansen (1961), Kuz'mina (1992), Li Wen fa & Zhao Ying-jie (1987), Litun (1982, 1984, 1987, 1991, 1992), Meyer de Schauensee (1984), Potapov & Flint (1989), Rogacheva (1992), Yang (1990), Zhong Zheng-wang & Wu Yi-ching (1992), Zhao Zheng-jie, Wu Jingcai & Zhang Shuhua (1992), Zhao Zheng-jie, Zhang Shuhua & Feng Kai Feng (1992).

61. Tibetan Partridge

Perdix hodgsoniae

French: Perdrix de Hodgson

German: Tibetbrebhuhn

Spanish: Perdiz Tibetana

Other common names: Hodgson's Partridge

Taxonomy. *Sacca Hodgsoniae* Hodgson, 1857, Tibet.

Has been separated in monospecific genus *Sacca*. Three subspecies recognized.

Subspecies and Distribution.

P. h. sifanica Przevalski, 1876 - WC China, from C Qinghai and Gansu S to E Tibet and C & S Sichuan.

P. h. caraganae R. & A. Meinertzhagen, 1926 - NW India (E Kashmir) E to E Tibet.

P. h. hodgsoniae (Hodgson, 1857) - W Nepal E to NE India (Assam) and E Tibet.



Descriptive notes. c. 28 cm; male 294-370 g. Very distinctive head and neck pattern. Female slightly smaller than male. Immature duller, with no chestnut.

Habitat. Usually dry hillsides with scattered juniper bushes, and near cover such as crops, grass or brush; in summer generally above 3600 m and below 4600 m, but occurs up to 5600 m.

Food and Feeding. Virtually no information available; probably eats a variety of seeds and insects.

Breeding. Season from May to Jul, or even Aug. Nest is a scrape (20-22 cm in diameter) sometimes no nest at all. Lays 8-10 eggs

in the ground, lined with grass, situated under cover; sometimes no nest at all. Lays 8-10 eggs (6-12). No further information available.

Movements. Very little information available; in India found between c. 3600 m and 5600 m; usually below 4000 m in winter, and sometimes down to 2800 m. Flies only if pressed, birds "exploding" downhill when flushed.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Believed safe, as widely distributed and considered fairly common in China and locally quite common in India. No other information on status or threats available. Whilst its two congeners are widely hunted, present species occurs at higher altitudes, in areas that seem to be largely free from human pressures.

Bibliography. Ali & Ripley (1980), Baker (1930), Cheng Tso-hin (1987), Cheng Tso-hin *et al.* (1978), Etchécopar & Hùe (1978), He Fen-qi & Cui Xie-zhen (1990), Inskipp & Inskipp (1985), King & Peng Ji-tai (1991), Mallon (1987), Meyer de Schauensee (1984), Robson (1986).

Genus RHIZOTHERA G. R. Gray, 1841

62. Long-billed Partridge

Rhizothera longirostris

French: Perdrix à long bec

German: Langschnabelwachtel

Spanish: Perdiz Piquilarga

Other common names: Long-billed Wood-partridge

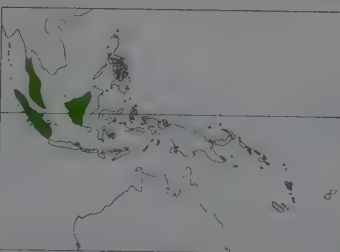
Taxonomy. *Perdix Longirostris* Temminck, 1815, Sumatra.

Two subspecies recognized.

Subspecies and Distribution.

R. l. longirostris (Temminck, 1815) - S Burma and S Thailand S through Malay Peninsula to Sumatra; W & S Borneo.

R. l. duliensis Ogilvie-Grant, 1895 - mountains of N Borneo.



Descriptive notes. c. 37 cm; male c. 800 g, female c. 697 g. Long, fairly stout decurved bill distinctive. Female all rich rufous below; can have spurs. Immature resembles female, but has some barring on flanks and breast. Race *duliensis* differs mainly in all whitish belly.

Habitat. Dry forest, especially in areas with bamboo, from sea-level up to 1000-1500 m, including high level tea estates in Sumatra. Favours limestone hills.

Food and Feeding. Berries, grasses, seeds and insects.

Breeding. Only one nest known, found in Feb

containing 2 eggs, a shallow scrape lined with root fibre and bamboo leaves, placed amongst bamboo bushes. In captivity: lays 2-5 eggs; incubation 18-19 days.

Movements. No information available; presumably sedentary.

Status and Conservation. Not globally threatened. Mace-Lande: Vulnerable. Never widely encountered, as calling is very sporadic, status and trend therefore implied from state of its known

habitat. Possibly extinct in Thailand from where there are no recent records; sparsely distributed in Malaysia (both Peninsular and Bornean); present in Gunung Leuser National Park in N Sumatra, and possibly also at Ulu Barito in Kalimantan. Most historical sites in Kalimantan now largely deforested; this is probably also true for Sumatra and Peninsular Malaysia. Whilst most known sites are in lowlands, species does occur in lower montane forest, in Indonesia at least, and such habitat is still widespread in Sumatra and Peninsular Malaysia. Not recorded in any protected area in Thailand, although may occur in one or two; known from Krau Wildlife Reserve (530 km²), Taman Negara National Park (4343 km²) and Fraser's Hill Wildlife Sanctuary (30 km²) in Peninsular Malaysia, and Danum Valley Research Centre in Sabah, NE Borneo; in Indonesia, recorded in Gunung Leuser National Park (7927 km²) in N Sumatra, but no records from any protected area in Kalimantan; not protected by Indonesian law. Threatened by loss and alteration of habitat which takes place in variety of ways; clear-felling of forest for timber, loss of forest to agriculture and habitat degradation. CITES III in Malaysia.

Bibliography. Andrew (1992), Baker (1935), van Balen (1992), Chasen (1939), Crowe & Crowe (1985), Davison & Scriven (1987), Gibson-Hill (1949), Holmes (1989), Johns (1986, 1989), Lekagul & Round (1991), MacKinnon & Phillips (1993), Mudoc (1976), van Marle & Voous (1988), Medway & Wells (1976), Robinson & Chasen (1936), Robinson & Kloss (1921, 1924), Round (1988), Schönwetter (1967), Showler (1993), Smythies (1957, 1981), Wells (1985).

Genus *MARGAROPERDIX*

Reichenbach, 1853

63. Madagascar Partridge

Margaroperdix madagarensis

French: Perdrix de Madagascar

German: Perlwachtel

Spanish: Perdiz Malgache

Taxonomy. *Tetrao madagarensis* Scopoli, 1786, Madagascar.

Emendation of species name to *madagascarensis* is not justified. Monotypic.

Distribution. Madagascar.

Introduced to Reunion.



Descriptive notes. c. 26-30 cm; c. 220 g. Small hindclaw. Male quite unmistakable, with striking patterns on head and underparts. Female all dull brownish, but distinctively patterned below with large scallops. Immature undescribed, but apparently similar to female.

Habitat. Forest areas and brushland, mostly frequenting secondary habitats; also found in grassland and weedy farmland. Occurs from sea-level to 2700 m.

Food and Feeding. No information available; probably feeds on seeds, berries, roots and insects.

Breeding. Nests in Mar-Jun. Nest situated on the ground, well hidden in a tuft of grass. Lays 15-20 eggs; downy young similar to those of *Coturnix*.

Movements. No information available; presumably sedentary.

Status and Conservation. Not globally threatened. Mace-Lande: Vulnerable. Formerly common in the E & C regions of island; anecdotal evidence indicates serious decline since 1930's; could now be very scarce, and numbers might have decreased more than is currently thought. Considered a candidate for inclusion in Red Data Book in 1985. A population estimate in the tens of thousands is based only on extent of distribution and comments on relative abundance. Occurs in several protected areas, comprising 2 national parks, 6 integral reserves and 5 special reserves. Potentially

4266 km² of protected area in 13 blocks which may be suitable for species. Also recorded in 8 out of 18 Sites of Biological Interest which are proposed as additions to protected area network. Threatened by habitat degradation resulting from annual fires which are converting brushland to grassland; also heavily exploited through hunting with dogs, and is caught by trappers using rice-baited snares.

Bibliography. Crowe & Crowe (1985), Dee (1986), Frost (1975), Langrand (1990), Milon *et al.* (1973), Nicoll & Langrand (1989), Raethel (1988), Rand (1936), Schönwetter (1967).

Genus *MELANOPERDIX* Jerdon, 1864

64. Black Wood-partridge

Melanoperdix nigra

French: Perdrix noire

German: Schwarzwachtel

Spanish: Perdiz Negra

Other common names: Black Partridge

Taxonomy. *Cryptonyx niger* Vigors, 1829, no locality.

Two subspecies recognized.

Subspecies and Distribution.

M. n. nigra (Vigors, 1829) - Peninsular Malaysia and Sumatra.

M. n. borneensis Rothschild, 1917 - Borneo.



Descriptive notes. c. 24-27 cm; c. 260 g. Male very distinctive, showing combination of short thick bill and glossy black plumage. Peculiar bill distinguishes female from other predominantly chestnut species: upperparts almost unmarked. Immature male resembles female; immature female is paler above, with blackish vermiculations. Races similar.

Habitat. Primary lowland forest, usually with many spiny stemless palms in undergrowth; also in wetland forest in Sumatra and Kalimantan. Down to sea-level, but upper altitude limit unknown; has been reported recently at 1200 m in Ulu Barito, Kalimantan.

Food and Feeding. No information available.

Breeding. Little information available. One clutch of 2 eggs found in Jan, one of 3 in May, and three of 5 eggs in Sept, all in Borneo; downy young seen in late Oct. Incubation 18-19 days (in captivity).

Movements. No information available; presumably sedentary. Runs when disturbed, although typically sits tight until approaching human is only a few metres away.

Status and Conservation. Not globally threatened. Mace-Lande: Vulnerable. Currently considered near-threatened. Believed to be very sparsely distributed in Peninsular Malaysia and probably also in Indonesia. Extreme scarcity of records makes any population estimate very difficult, but numbers presumed to be decreasing; never widely encountered, and status and trend therefore implied from current state of known habitat. Wetland and peat swamp forest still widespread in Indonesia but even this habitat type is now becoming threatened. Occurs in Pasoh Forest Reserve, Krau Wildlife Reserve and Gunung Mulu National Park in Malaysia; and, in Indonesia, in Berbak Game Reserve in Sumatra, and Tanjung Puting National Park and Gunung Palung Nature Reserve in Kalimantan. Not protected by Indonesian law. Threatened by habitat loss and alteration: clear-felling for timber; forest loss to agriculture; and forest degradation. Clarification of species' distribution, especially in protected areas, is required, as is general research. CITES III in Malaysia.

Bibliography. van Balen (1992), Chasen (1939), Coomans de Ruiter (1946), Crowe & Crowe (1985), Davison & Scriven (1987), Dutson (1990), Gibson-Hill (1949), Holmes (1989), MacKinnon & Phillips (1993), van Marle & Voous (1988), Medway & Wells (1976), Riley (1938), Robinson & Chasen (1936), Schönwetter (1967), Smythies (1957, 1981), Wells (1985).



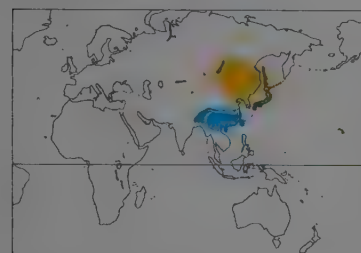
Genus *COTURNIX* Bonnatere, 1791

65. Japanese Quail

Coturnix japonica

French: Caille du Japon **German:** Japanwachtel **Spanish:** Codorniz Japonesa
Other common names: Asian Migratory Quail

Taxonomy. *C. vulgaris japonica* Temminck and Schlegel, 1849, Japan. Forms superspecies with *C. coturnix*, and possibly also with *C. pectoralis*. Present species has been considered a race of *C. coturnix*, but they are apparently sympatric in Mongolia. Monotypic. **Distribution.** Breeds in E Asia, from N Mongolia, NE through Baikal region to Vitim region in EC Russia, E to Sakhalin I, and S to Japan, Korea and NE China (E Shandong); winters S from C Japan and C China W through NW Thailand and N Burma to NE India (Assam) and Bhutan. Records from NW Bangladesh usually ascribed to *C. coturnix*, but may actually be applicable to present species. May breed in Buthan and Burma. Introduced to Hawaiian Is.



Descriptive notes. c. 17-19 cm; c. 90 g. Usually indistinguishable in the wild from *C. coturnix*, except on call; in the hand, distinguished by having wing under 10.5 cm long, small "beard" in autumn and winter, and more rufous coloration in spring. Some males may show partial collar on throat. Female differs from that of *C. coturnix* in pattern of underparts; intermediate forms known to occur. Immature male has throat like female, but suffused with brick red in centre.

Habitat. Little information available; open habitats in similar situations to those used by *C. coturnix*, but possibly damper meadows.

and also steppes and dry mountain slopes near water. Records from Bangladesh in grassland and cultivation.

Food and Feeding. Wide variety of plant materials; in summer, also takes terrestrial invertebrates. **Breeding.** Laying (including renests) from late Apr to early Aug in Russia; late May to Aug (Sept) in Japan; Mar-Jul (possibly present species) in NW Bangladesh. Usually 9-10 eggs in Russia, 5-8 in Japan; incubation 18 days, by female only.

Movements. Annual migrations; in Japan, of over 1000 ringed birds recovered, only 3 originated outside Japanese islands; a few birds winter in Russia, apparently coming from more northerly parts; breeds in N & NE China and winters in S China, including Hainan and Taiwan.

Status and Conservation. Not globally threatened. Mace-Landé: Safe. No reliable estimates of numbers, but species considered fairly common in China. Formerly regarded as widespread on Taiwan, where was fairly plentiful in E Kurenko District, but few recent records. Suitable habitat probably widespread in NW Thailand, but too few records to estimate abundance; sometimes considered only rare migrant to the country. Very few records from Bhutan as well, where was common in 1930's; also visits Assam, NE India, in small numbers. Clearly species is poorly known, and lack of records is a cause for concern. Loss and degradation of habitat are problems in some areas, e.g. Taiwan, but actual or potential threats are not known for most of range.

Bibliography. Ali & Ripley (1980), Austin (1948), Birkhead & Fletcher (1994), Brazil (1992), Cheng Tso-hin (1987), Clements (1992), Deignan (1945), Dementiev & Gladkov (1952), Dickinson *et al.* (1991), Etchécopar & Hue (1978), Fenna & Boag (1974), Flint *et al.* (1984), Harvey (1990), Inskipp & Inskipp (1993b), Kuz'mina (1992), McClure (1974), Meyer de Schauensee (1984), Potapov & Flint (1989), Robson (1990), Sarker (1986), Smythies (1986), Taka-Tsukasa (1967), Vaurie (1965d), Zeng Yang-zhi & He Fen-qui (1990).

66. Common Quail

Coturnix coturnix

French: Caille des blés **German:** Wachtel **Spanish:** Codorniz Común
Other common names: European/Eurasian (Migratory) Quail (*coturnix*); African Quail (*africana*)

Taxonomy. *Tetrao Coturnix* Linnaeus, 1758, Europe, Asia, Africa = Sweden. Forms superspecies with *C. japonica*, and possibly also with *C. pectoralis*. Internal taxonomy complex and somewhat confused. Present species has been considered to include *C. japonica* as a race, but the two are apparently sympatric in Mongolia. African populations may constitute a separate species, *C. africana*. Birds of E & C Africa often considered to merit subspecific distinction from those in S Africa, and thus awarded race *erlangeri*; this race formerly applied to Ethiopian population only. Birds of S Africa frequently transferred to nominate *coturnix*, as deemed to be inseparable; under such an arrangement, *erlangeri* applied to birds of E & C Africa, and sometimes raised to full species level. Four subspecies recognized.

Subspecies and Distribution.

C. c. coturnix (Linnaeus, 1758) - British Is and NW Africa E to EC Russia and EC India, and possibly to Bangladesh; winters mainly in Sahel zone of Africa and C & S India.

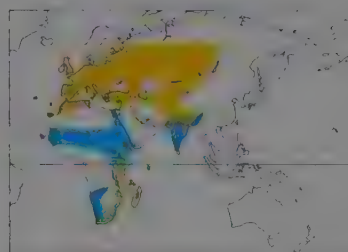
C. c. confisa Hartert, 1917 - Canary Is, Madeira and Azores.

C. c. inopinata Hartert, 1917 - Cape Verde Is.

C. c. africana Temminck & Schlegel, 1849 - sub-Saharan Africa, from Ethiopia and Uganda to S Angola and South Africa (Cape Province), and also Madagascar and Comoros Is; birds from S Africa winter in Angola, S Zaire, N Namibia and W Zambia.

Records from NW Bangladesh normally ascribed to present species (nominate *coturnix*), but perhaps more likely to refer to *C. japonica*. Introduced (*africana*) to Reunion and Mauritius.

Descriptive notes. 16-18 cm, 70-155 g; wingspan 32-35 cm. Usually indistinguishable in the wild from *C. japonica*, except on call; in the hand, differs by having wing over 10.5 cm long, and usually by being less rufous below, from other (*Coturnix*) separated by having outer webs of primaries barred with buff. Female distinguished from *C. japonica* by pattern of underpart feathers



Immature resembles female, but has barred flanks and no lines on lower cheeks. Races vary slightly in size and colour; Palearctic birds larger, paler and greyer, African birds generally smaller, darker and more rufous.

Habitat. Open habitats, including cultivation, in level or gently rolling land; up to 1000 m and much higher in places. Prefers dense herb-herb less than 1 m tall. In NE Tanzania, where breeds alongside *C. delegorguei*, occurs in longer, less degraded grassland. Avoids bare soils.

Food and Feeding. Opportunistic, eating mainly seeds of grasses, weeds and grain, with

well over 100 plant species recorded. Also takes invertebrates from ground, e.g. beetles, bugs, ants, earwigs, grasshoppers, spiders, worms and molluscs.

Breeding. Laying from mid-May to Aug in N Europe, late Mar to mid-June in S Europe; any month in E Africa, but Jan-Feb in Kenya; Sept-Mar in S Africa. Both monogamy and promiscuity reported. Nest is scrape with grass added, constructed by female; sited in herbaceous and grassy cover. Normally 8-13 eggs (4-15) in Europe and 5-7 eggs (2-14) in Africa; incubation 17-20 days, by female only; downy chicks have long blackish stripes on rufous brown upperparts, buffy underparts; chicks can flutter from ground at 11 days; fledging c. 19 days. Young independent after 50-70 days.

Movements. Complex. Majority of W Palearctic breeding birds believed to winter S of Sahara, mainly in Sahel zone, but some winter as far N as British Is and Germany, and with some regularity around Mediterranean; birds of these populations do not seem to cross over equatorial forest; migration routes believed to vary individually, and from year to year. Birds that winter in C & S India believed to migrate through NW Pakistan, before dispersing throughout Indian Subcontinent. S African birds may move N to winter in Angola, S Zaire, N Namibia and W Zambia, where species is probably non-breeding visitor.

Status and Conservation. Not globally threatened. Mace-Landé: Safe. Little information available from which to assess status; problem confounded by occasional and irregular movements in some areas which help to mask long-term trends. Local fluctuations in numbers reported in most areas, with underlying decline in progress in several countries, including parts of France, Netherlands, Germany, Italy, Romania, Ukraine, Russia, Cyprus and Malta, and on most other islands too. Nominate *coturnix* considered abundant to very abundant according to season in some parts of Africa; race *africana* locally abundant. Introduced population on Mauritius only maintained by constant restocking. Hunting of migratory birds is a major problem, especially in parts of Africa; around turn of century, several million birds of nominate *coturnix* were netted in Sinai and other parts of Egypt, when on migration, and hunting still intense; agricultural intensification is possibly also a threat in some areas, especially with increasing use of pesticides. In India, species considered very abundant locally, but numbers vary considerably from year to year; migrants trapped in Pakistan, where species still considered common, but less so than formerly; widely hunted in NW India. Status uncertain in S Arabia: where species is probably only a visitor.

Bibliography. Ali & Ripley (1980), Backhurst *et al.* (1973), Bannerman (1953, 1963), Benson (1960a, 1963), Britton (1980), Cheng Tso-hin (1987), Clancey (1967), Combreau & Guyomarc'h (1989), Courtney-Latimer & Clancey (1960), Cramp & Simmons (1980), Dementiev & Gladkov (1952), Etchécopar & Hue (1978), Flint *et al.* (1984), Gallagher & Woodstock (1980), Gao Jin-hua & Zhang Bing (1984), Ginn *et al.* (1989), Goodman *et al.* (1989), Guyomarc'h (1992), Guyomarc'h *et al.* (1987a, 1987b, 1989, 1990), Holmes (1986), Hudson *et al.* (1985), Inskipp & Inskipp (1985), Jackson & Selator (1978), Kane (1993), Kuz'mina (1992), Langrand (1990), Leveir (1987), Mackworth-Prue & Grant (1957-1973), Maclean (1993), Marchant *et al.* (1990), Meinertzhagen (1954), Mendelssohn *et al.* (1969), Moreau (1963), Moreau & Wayne (1968), Parkes (1993), Paz (1987), Pinto (1983), Potapov & Flint (1989), Puigecerver (1991), Puigecerver *et al.* (1989, 1991), Richardson (1990), Roberts (1991), Rodriguez Teijeiro *et al.* (1992), Rogacheva (1992), Schleidt (1983), Sessions (1967), Simeonov *et al.* (1990), Snow (1978), Urban *et al.* (1986), Vincent (1934).

67. Harlequin Quail

Coturnix delegorguei

French: Caille arlequin **German:** Harlekinwachtel **Spanish:** Codorniz Arlequin

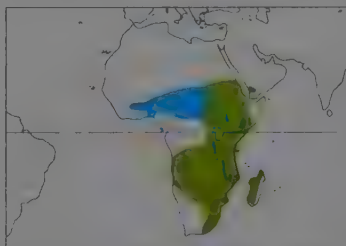
Taxonomy. *Coturnix delegorguei* Delegorgue, 1847, Oury, Upper Limpopo River, Transvaal. Forms superspecies with *C. coromandelica*. Three subspecies recognized.

Subspecies and Distribution.

C. d. arabica Bannerman, 1929 - S Arabia.

C. d. delegorguei Delegorgue, 1847 - Ivory Coast to Ethiopia and S to South Africa (E Cape Province), excluding forest belt and arid SW Africa; apparently only migrant to W Africa.

C. d. histrionica Harlaub, 1849 - São Tomé, Gulf of Guinea.



Descriptive notes. 16-19 cm; male 49-81 g, female 63-94 g. Male has very distinctive combination of black and white head pattern, black breast and chestnut flanks. Female very similar to that of *C. coturnix*, but distinguished in the hand by unbarred outer webs of primaries. Immature resembles female but paler below and on crown. Races differ mainly in tone of plumage coloration.

Habitat. Favours open grassland with scattered bush cover and cultivated areas; also patches of grass in damp situations, e.g. along watercourses. In NE Tanzania, where breeds alongside *C. coturnix*, occurs in shorter, more

degraded grassland.

Food and Feeding. Grass and weed seeds, including *Eleusine*, *Setaria*, *Brachiaria*, *Sorghum*, *Pariplocoeris*, and green shoots; also grasshoppers, beetles, bugs, caterpillars, ants, termites and small ground molluscs.

Breeding. Season associated with heavy rains, irregular with much local variation. Oct-Mar in E South Africa; Jul-Sept in Namibia; Oct-Jun in Zimbabwe; May-Jun and Nov-Dec in Kenya and N

On following pages: 68. Rain Quail (*Coturnix coromandelica*); 69. Stubble Quail (*Coturnix pectoralis*); 70. Brown Quail (*Coturnix ypsilophora*); 71. Asian Blue Quail (*Coturnix chinensis*); 72. African Blue Quail (*Coturnix adansonii*); 73. Snow Mountain Quail (*Anurophasis monorhynx*).

Tanzania: Apr-Jun in Ethiopia; Jul in Sudan; probably all year on São Tomé. Possibly polygynous; sometimes forms loose colonies. Nest is a small scrape with sparse lining, concealed among tufts of grass in grassland. Usually 4-8 eggs; incubation 14-18 days, by female alone; downy chicks have dark brown, black and buff stripes above, buffy yellow underparts; chicks can fly short distances at 5 days.

Movements. Pattern varies according to locality. Nomadic in E & C Africa, movements seemingly associated with rains, but more regular movements may occur in some areas. In S Africa migrates S to breed in rains, and mostly flies N in dry season, but not to same area every year. Situation uncertain in W Africa, where no definite breeding records, and species is probably only a rather irregular migrant: movements in Nigeria particularly confusing, but species is apparently commonest in N during rains, with some southward movement during dry season; dry season migrant to Ivory Coast; only one record each from N Cameroon and Ghana; said to breed in Chad. Various movements reported in other areas.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Little specific information available. Considered to be at least common and even abundant in some areas; no indication that overall numbers are decreasing. Known to be trapped in some areas, e.g. along Kavirondo Gulf (L. Victoria); birds are locally taken for food.

Bibliography. Ash (1992), Backhurst & Pearson (1977), Backhurst *et al.* (1973), Benson (1963), Benson & Benson (1975), Britton (1980), Brown & Britton (1980), Clancey (1967), Elgood (1982), Erlanger (1905, 1907), Ginn *et al.* (1989), Grimés (1987), Hartley & Mundy (1992), Jackson & Slater (1938), Lack (1985), Lack *et al.* (1980), Langrand (1990), Lewis & Pomeroy (1989), Louette (1981), Mackworth-Pratt & Grant (1957-1973), Maclean (1993), Meinhartzen (1954), Milon *et al.* (1973), Pinto (1983), Pomeroy & Abe (1992), Sessions (1967), Urban *et al.* (1986), Vincent (1934).

68. Rain Quail

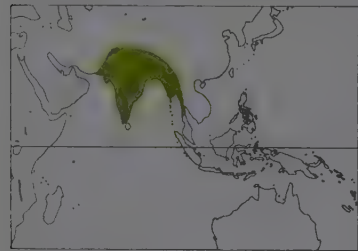
Coturnix coromandelica

French: Caille natchée **German:** Regenwachtel **Spanish:** Codorniz Coromandélica
Other common names: Black-breasted Quail

Taxonomy. *Tetrao coromandelicus* Gmelin, 1789. Coromandel coast.

Forms superspecies with *C. delegorguei*. Monotypic.

Distribution. Pakistan E to Burma and W Thailand and S through India. Recent record from S Vietnam would extend range to SE considerably.



Descriptive notes. c. 16.5 cm; 64-85 g. Male has distinctive underpart pattern. Female almost indistinguishable in wild from those of three preceding species, but much less distinctly spotted on breast. Young male has less prominent markings on throat and breast.

Habitat. Generally open habitats including grassland, cultivation, dry scrub, meadows and scrub jungle, up to c. 2000 m in the Himalayas.

Food and Feeding. Grass and weed seeds, and insects.

Breeding. Nesting during wet season, generally Mar-Oct, but may vary according to local rainfall. Nest in crops or grass, sometimes in scrub or bush. Lays 4-6 eggs; incubation 18-19 days, by female only.

Movements. Irregular dispersal before breeding in Pakistan where arrives in plains in late Jun, departing from E & S in early Oct. In India, resident and nomadic, or locally migratory during SW monsoon, when moves to areas too dry to inhabit at other times. Occasionally reaches Sri Lanka. Vagrant to Nepal.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Considered safe on the basis of its extensive range and subjective estimates of numbers and trend in some areas. Apparently widespread in grassland and cropland throughout India, where numbers may be stable; in Pakistan considered frequent, although irregular movements make assessment of trends difficult; one recent record from Bangladesh in 1989, where may be very local resident in SE; possibly widespread and under-recorded in Thailand.

Bibliography. Ali & Ripley (1980), Baker (1930), Harvey (1990), Holmes (1986), Inskipp (1989), Inskipp & Inskipp (1985), Kaul & Howman (1991), Lekagul & Round (1991), Ripley (1982), Roberts (1991), Robson *et al.* (1993b), Sankar *et al.* (1993), Sarker (1986), Smythies (1986), Zacharias & Gaston (1993).

69. Stubble Quail

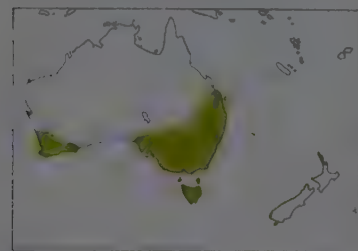
Coturnix pectoralis

French: Caille des chaumes **German:** Schwarzbrustwachtel **Spanish:** Codorniz Pectoral
Other common names: Grey/Pectoral Quail

Taxonomy. *Coturnix pectoralis* Gould, 1837. New South Wales.

Some authors include present species in superspecies formed by *C. coturnix* and *C. japonica*. Sometimes considered race of extinct *C. novaezealandiae* of New Zealand. Monotypic.

Distribution. Australia (mainly in SE & SW); formerly throughout Tasmania, where now very rare, with only three published records since 1977.



Descriptive notes. 16-20 cm; 75-125 g; wingspan 25-33 cm. Male has distinctive brick red face and throat. Female similar to that of *C. coturnix* in size; differs from preceding species by paler and more streaked underparts. Immature male resembles female, but has broader black markings on underparts.

Habitat. Most habitats except forest, especially grassland and well drained cultivation; prefers zones of tall, dense ground vegetation 10-75 cm (preferably 25-50 cm), though also present in areas of low cover, and occasionally even on bare ground, if food abundant. Range can extend into arid zone after rainfall or

flooding.

Food and Feeding. Primarily seeds of grasses, cultivated cereals and weeds; important species are *Avena sativa*, *Hordeum vulgare*, *Lolium perenne*, *Triticum aestivum*, *Polygonum aviculare* and

Cirsium vulgare. Also leaves, buds and flowers of legumes and herbs, and some invertebrates, mainly insects; in several studies, animal items accounted for between 9.3% and 32.3% of total food consumed. Usually forages on the ground, where scratches and gleans, though also climbs wheat stalks to pick seed from heads.

Breeding. Nesting Aug-Mar in most of range, but may vary according to local rainfall pattern. Probably monogamous. Nest is scrape in ground, lined with dried grass, situated in crops or grass. Normally 7-8 eggs (6-14); incubation 18-21 days, by female only; downy chicks are striped ginger brown and black-brown above, pale buff below; young are capable of weak flight at 16 days. Sexual maturity reached at 2-15 months. Breeding success in one study, 26 young reared from 41 eggs laid.

Movements. Most populations nomadic, with opportunistic distribution and reproductive cycles, moving mainly in response to rainfall and food availability. Other populations resident. Irruptions into areas beyond normal range occur occasionally after good rains, especially when numbers have built up during favourable breeding season. Movement of up to 1300 km recorded.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. In Australia, range has expanded and numbers have increased as result of human activities, with species moving into agricultural areas; forest clearance, irrigation and establishment of crops and pastures are all beneficial. In contrast, intensely cultivated or grazed areas are unsuitable for present species. Serious decline in Tasmania, where species almost disappeared by 1953, despite full protection since 1944, coinciding with widespread improvement of pastures. Still present in several islands of Bass Strait, such as Flinders I, where reported to be scarce, and King I, where appears to be common. Suffers considerable hunting pressure, with between 500,000 and 1,000,000 birds shot annually in Victoria during 1930's. Agricultural machinery frequently causes destruction of eggs, young and adults.

Bibliography. Blakers *et al.* (1984), Cruise (1966), Disney (1978), Frith & Carpenter (1980), Frith & Waterman (1977), Frith *et al.* (1977), Macdonald (1988), Marchant & Higgins (1993), McNally (1956), Oliver (1955), Schodde & Tidemann (1988).

70. Brown Quail

Coturnix ypsilophora

French: Caille tasmane **German:** Tasmanienwachtel **Spanish:** Codorniz Tasmana
Other common names: Swamp Quail (*ypsilophora*)

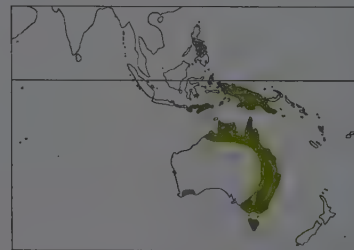
Taxonomy. *Coturnix ypsilophorus* Bosc, 1792, no locality = Tasmania.

Previously placed in genus *Syncoicus*. All races except nominate *ypsilophora* have been considered separate species, *C. australis*, but morphological differences between some of these greater than those between *australis* and *ypsilophora*. Populations of N Queensland, NW Australia and SW Australia have been separated in races *queenslandica*, *cervina* and *sordida* respectively; but differences slight, while there is no clear relation between geographical distribution and colour or pattern of plumage. Ten subspecies normally recognized.

Subspecies and Distribution.

- C. y. raathenii* (S. Müller, 1842) - Lesser Sundas, on Flores, Timor and adjacent islands.
- C. y. pallidior* (Hartert, 1897) - Lesser Sundas, on Sumba and Sawu.
- C. y. saturator* (Hartert, 1930) - lowlands of N New Guinea.
- C. y. lamonti* Mayr & Gilliard, 1954 - moderate heights in mountains of C New Guinea.
- C. y. dogwa* Mayr & Rand, 1937 - lowlands of S New Guinea.
- C. y. plumbeus* (Salvadori, 1894) - lowlands of E New Guinea.
- C. y. monticola* Mayr & Rand, 1937 - alpine areas of SE New Guinea.
- C. y. majulu* Mayr & Rand, 1937 - S slopes of mountains in SE New Guinea.
- C. y. australis* (Latham, 1801) - Australia.
- C. y. ypsilophora* Bosc, 1792 - Tasmania.

Introduced to New Zealand and Fiji.



Descriptive notes. 17-22 cm; 75-140 g; wingspan 26-36 cm. Differs from *C. pectoralis* in barred, not streaked, underparts; larger than *C. chinensis*, smaller and less heavily barred than *Anuophasis monorthonyx*. Female paler overall, with different black markings on upperparts. Immature has more distinct shaft streaks. Races differ mainly in size, and also in colour and pattern of plumage of males; *dogwa* very distinctive, all dark slate.

Habitat. Wet grassland and shrubland, especially in rank grass and moist meadows; also in cereal crops, stubble, coastal scrub, open

woodland and in reedbeds or stands of other dense aquatic vegetation fringing freshwater wetlands; high ground during heavy rainfall. In Australia, prefers well watered areas, but appears far inland, in ephemeral patches of grassland formed after flooding, in years with heavy rains.

Food and Feeding. Mainly seeds of grasses and herbs (*Dactyloctenium*, *Triticum*, *Digitaria*, *Oryza*, *Panicum*, *Stipa*, *Paspalum*, *Lolium*, *Alternanthera*, *Rubus*, *Arctotheca*) and some leaves (*Trifolium*); also some animals, including worms and isopods, a gecko 7.5 cm long, and adults and larvae of insects, e.g. beetles, butterflies and grasshoppers. Forages on ground, gleaning in litter and soil, usually in pairs or small coveys.

Breeding. Season Aug-Jan in S Australia; 2-4 months later in N Australia; Nov-Mar in Tasmania. Monogamous, at least in captivity. Nest is a scrape on the ground, c. 2.5 cm deep, lined with grass and leaves, placed in grass or other dense ground vegetation. Normally 7-11 eggs (up to 14) in Australia, 4-6 in New Guinea; may raise numerous broods in a season; incubation 21-22 days, by female alone; chicks have dark brown and buff down above, dull brown mottled cream below; young capable of flight at 10-17 days.

Movements. Believed to be fairly restricted to wet areas, although may move to high ground during flooding. In Australia, irregularly visits semi-arid and arid districts after good rains have promoted the growth of vegetation. Irruptions beyond normal range occur after favourable breeding seasons.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Little detailed information available. Believed to have suffered with wetland drainage, intensive cultivation, burning of habitat, and increased salinity in some areas, but has benefited in others from increase in extent of stubble fields, irrigation, establishment of pastures and clearance; overall thought to have lost more habitat than has gained, but not considered under threat.

Bibliography. Andrew (1992), Beehler (1978), Beehler *et al.* (1986), Coates (1985), Goodwin (1975), Holmes (1989), Lever (1987), Macdonald (1988), Marchant & Higgins (1993), Mayr (1944), Rand & Gilliard (1967), Schodde & Tidemann (1988), Schönwetter (1967), Westerskov (1985), White & Bruce (1986).

71. Asian Blue Quail

Coturnix chinensis

French: Caille peinte

German: Zwergwachtel

Spanish: Codorniz China

Other common names: King/Painted/Blue-breasted/Chinese Quail

Taxonomy. *Tetrao chinensis* Linnaeus, 1766. China and the Philippines = Nanking, China. Previously placed in genus *Excalfactoria*. Sometimes considered conspecific with *C. adansonii*, with which forms superspecies. As consequence of transfer of present species from *Excalfactoria* to *Coturnix*, subspecies name *australis* preoccupied by *C. psilophora australis*, so gives place to junior synonym *victoriae*. Ten subspecies recognized.

Subspecies and Distribution.

C. c. chinensis (Linnaeus, 1766) - India and Sri Lanka E through Indochina to SE China and Taiwan, and S to Malay Peninsula.

C. c. trinkuensis (Richmond, 1902) - Nicobar Is; also said to occur in Andaman Is (race unspecified).

C. c. palmeri (Riley, 1919) - Sumatra and Java.

C. c. lineata (Scopoli, 1786) - Philippines, Borneo and Sulawesi.

C. c. lineatula (Rensch, 1931) - Lombok E to Timor, Lesser Sundaes.

C. c. novaeguineae Rand, 1942 - mountains of New Guinea.

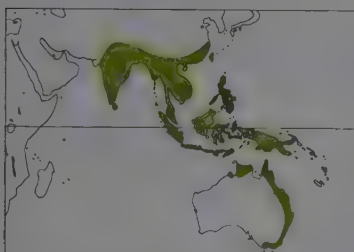
C. c. papuensis Mayr & Rand, 1937 - SE New Guinea.

C. c. lepida (Hartlaub, 1879) - Bismarck Archipelago.

C. c. collettii (Mathews, 1912) - Northern Territory, Australia.

C. c. victoriae (Mathews, 1912) - E Australia.

Introduced to Guam and SE Australia.



Descriptive notes. 12-15 cm; 20-57 g; wing-span c. 25 cm. Male very distinctive, differs from similar *C. adansonii* in chestnut belly and lack of chestnut wing patch. Female differs from that of *C. psilophora* by smaller size, and from that of similar *C. adansonii* by less distinct barring on upperwing-coverts. Immature male similar to adult female, but has more conspicuous black and buff markings above; immature female as adult, but with more spotted, less barred underparts. Races separated partly on darkness of plumage.

Habitat. Dense grassland, shrubland, swamp edges, cultivation with unkept areas and de-

pleted woodland; chiefly found in plains, but up to 2000 m in suitable habitat in India.

Food and Feeding. Apparently mainly grass seeds, green blades and some insects (especially termites), both adults and larvae. Forages on the ground, gleaning and scratching in litter.

Breeding. Season probably related to rainfall patterns: Sept-Mar in S Australia; Feb-Apr in N Australia; Jan-Aug in Peninsular Malaysia; Jun-Aug in NE India; Mar-Apr in S India. Monogamous, at any rate in captivity. Nest is depression on ground lined with dry grass. Normally 4-7 (up to 9) eggs; incubation 16-18 days, by female only; chicks have ginger brown down above with bold blackish stripes, buff below; young capable of flight at 4 weeks. Sexual maturity reached at 3 months.

Movements. In India, nomadic or migratory, for breeding moving to areas where rains have ended. Generally encountered in coveys of 6-7 birds, although up to 40 seen together. In Malay Peninsula, no evidence of regular migration, but species moves long distances, at least occasionally at night; similar movements recorded in Burma and Philippines.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Little detailed information available. Very widespread, but little recorded in most parts of range, although considered common in Malaysia. In India, considered sparsely distributed in small numbers over large areas; no recent records from Bangladesh. Considered safe because of extensive range, but more information clearly required on current status in all areas. Apparently erratic movements hamper status assessments.

Bibliography. Ali & Ripley (1980), Baker (1935), Chasen (1939), Cheng Tso-hun (1987), Coates (1985), Coomans de Ruiter (1946), Deignan (1945), Dickinson *et al.* (1991), Etchécopar & Hue (1978), Evans *et al.* (1993), Gibson-Hill (1949, 1952), Grimes (1987), Harrison (1965), Harvey (1990), Holmes (1989), Holmes & Burton (1987), Inskipp (1989), Inskipp & Inskipp (1985), Lekagul & Round (1991), MacKinnon (1988), MacKinnon & Phillips (1993), Mann (1987), Marchant & Higgins (1993), van Marle & Voous (1988), Medway & Wells (1976), Robinson & Chasen (1936), Robinson & Kloss (1921, 1924), Robson, Eames *et al.* (1993a, 1993b), Robson, Eames, Wolstencroft *et al.* (1989), Sankar *et al.* (1993), Sarker (1986), Schleidt *et al.* (1984), Schodde & Tidemann (1988), Smythies (1957, 1981, 1986), Zacharias & Gaston (1993).

72. African Blue Quail

Coturnix adansonii

French: Caille bleue

German: Adonsonwachtel

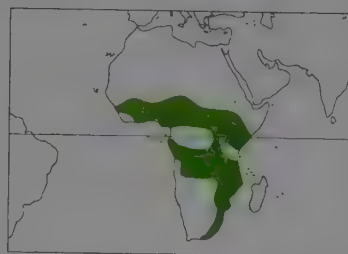
Spanish: Codorniz Africana

Other common names: Blue/King Quail

Taxonomy. *Coturnix Adansonii* J. and E. Verreaux, 1851. Gabon.

Formerly placed in genus *Excalfactoria*; sometimes considered a race of *C. chinensis*, with which forms superspecies. Monotypic.

Distribution. Sub-Saharan Africa, from Sierra Leone and S Mali E to S Ethiopia and NW Kenya, and S to Angola, Zimbabwe and E South Africa; not in W African forests or C Tanzania.



Descriptive notes. 15 cm; 43-46.6 g. Male differs from that of *C. chinensis* by chestnut wing-patch and flanks, and slaty belly. Female differs from that of *C. chinensis* by more distinct barring on upperwing-coverts; from other *Coturnix* females by small size and heavily barred underparts. Immature resembles female but has distinct pale shaft streaks on upperwing, rump and uppertail-coverts.

Habitat. Dense grassy habitats, such as thick grass along watercourses and swamps, and borders of cultivation; also occurs on granite outcrops in Sierra Leone. In Kenya, occurs in wetter grassland than *C. delegorguei*.

Food and Feeding. Grass and weed seeds, green plant matter, termites and other insects.

Breeding. Season is during or soon after rains: Nov and May-Jun in Cameroon; Apr-Jun in Uganda; Oct-Nov and May-Jul in Kenya; Feb-Jun in Malawi; Jan-Feb in Zambia; Jan-Apr in Zimbabwe; Dec-Apr in South Africa. Nest is a small scrape on ground below grass tussock, sometimes lined with grass. Lays 3-9 eggs; incubation c. 16 days, by female only.

Movements. Poorly known, but local movements reported in some areas, especially in W Africa, where apparently related to rains: in Ivory Coast, occurs in savanna N from coast mainly during Nov-May, in dry season; in Ghana, mostly recorded during rains, May-Jul, but during dry season in coastal areas; in Sierra Leone, where probably non-breeding migrant, present Nov-Jun, with both number of records and size of coveys peaking in Mar-May; arrives near Lagos, S Nigeria, in late Mar, during peak of rains, departing after breeding. In South Africa, may breed in summer, moving N in winter.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Little detailed information available. Very widespread species, considered to be local and uncommon in most areas. Widespread in C Angola, Zambia and Malawi, but sparsely distributed throughout most of range, absent where too dry, and fairly localized in Zimbabwe, Mozambique and E South Africa.

Bibliography. Ash (1992), Bannerman (1910, 1949, 1953), Benson (1963), Benson & Benson (1975), Britton (1980), Brown & Britton (1980), Clancey (1967), Ginn *et al.* (1989), Grimes (1987), Jackson (1911), Jackson & Selater (1938), Jones, M.A. (1979), Lewis & Pomeroy (1989), Louette (1981), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Nikolaus (1987), Pakenham (1979), Pinto (1983), Prigione (1985), Serle (1981), Snow (1978), van Someren (1925-1935), Urban *et al.* (1986).

Genus ANUROPHASIS van Oort, 1910

73. Snow Mountain Quail

Anurophasis monorthonyx

French: Caille de montagne

German: Schneegebirgswachtel

Spanish: Codorniz Papúa

Other common names: New Guinea Quail

Taxonomy. *Anurophasis monorthonyx* van Oort, 1910, at 3800 metres, Oranje (Snow) Mountains, New Guinea.

Has been included in genus *Coturnix*. Monotypic.

Distribution. Kemabu Plateau, and Mt Wilhelm and Mt Carstenz (Snow Mts), Irian Jaya, W New Guinea.



Descriptive notes. c. 25-28 cm; c. 401 g. Distinctive combination of large size and blackish barring above and below. Female paler, less rufous. Immature resembles adult, but with more irregular and less distinct barring.

Habitat. Found in alpine grassland and at edges of alpine scrub, on N slopes between 3100 m and 4000 m.

Food and Feeding. Flower heads, leaves, seeds and caterpillars reported.

Breeding. Only information is 3 eggs in a nest beside a grass tussock in Sept.

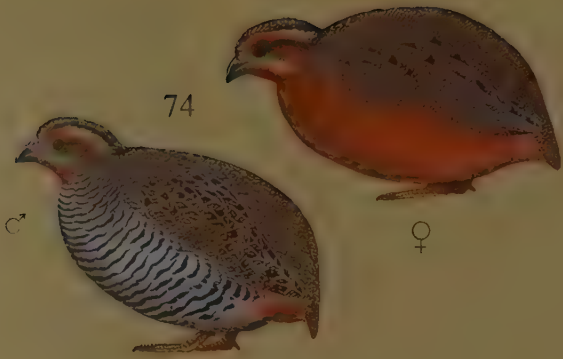
Movements. No information available.

Status and Conservation. Not globally

threatened. Mace-Lande: Safe. Currently considered near-threatened. Not protected by Indonesian law, but considered safe because of remote distribution in Snow Mts; very few records since late 1930's. Numbers probably low, given small range; occurs in Central New Guinean High Mountains Endemic Bird Area. Very low encounter rate makes direct assessment of trend impossible; population assumed to be stable, again because of occurrence in remote, generally inaccessible areas. Survey work in suitable habitat clearly needed.

Bibliography. Alderton (1992), Andrew (1992), Beechler *et al.* (1986), Molnes (1989), Iredale (1956), Jennings (1988), Rameil (1988), Rand (1942), Rand & Gilhard (1967), Ripley (1964), Schodde (1977).

74



ssp salimalii

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75

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ssp argoondah

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ssp griseata

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ssp torqueola

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PLATE 49



♂

ssp batemani

81

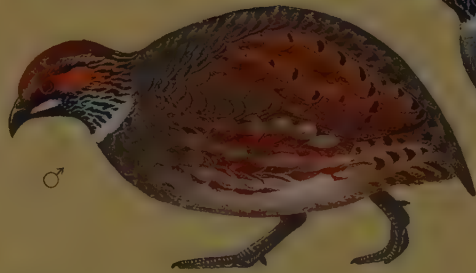
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Genus *PERDICULA* Hodgson, 1837

74. Jungle Bush-quail

Perdicula asiatica

French: *Pardicula rousse-gorge* German: *Dschungelwachtel* Spanish: *Pardicilla Golirroja*

Taxonomy. *Perdicula asiatica* Latham, 1790, Mahratta region, India. Four subspecies recognized.

Subspecies and Distribution.

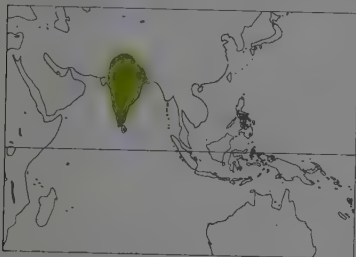
P. a. punjaubi Whistler, 1939 - NW India, from Kashmir to Uttar Pradesh.

P. a. vidali Whistler & Kinnear, 1936 - W India.

P. a. asiatica (Latham, 1790) - C & NE India, from Gujarat to Bihar.

P. a. ceylonensis Whistler & Kinnear, 1936 - Sri Lanka.

Introduced population on Reunion may still exist.



Descriptive notes. c. 15-18 cm; c. 57-82 g. Outermost primary longer than innermost, and inner webs of primaries brown, usually diagnostic; differs from *P. argoondah* by colour pattern of eyestripe and throat. Immature paler, with broader buffy stripes on upperparts. Races separated on coloration of upperpart plumage.

Habitat. Dry scrub and brush habitats, often stony, ranging from thin grass to fairly dense deciduous forests; recorded up to 1200 m.

Food and Feeding. Very little information available. Feeds on seeds, including those of grass, herbs, gram and millet, and some insects.

Breeding. End of rains to end of cold season: Jan-Mar in Karnataka, Oct-Mar in Deccan, Mar-Apr in EC India and Sri Lanka. Nest situated in cover. Lays 5-6 eggs (4-8); incubation 16-18 days (21 in captivity), by female alone; chicks have chestnut and dark brown down above, ochraceous grey below.

Movements. No information available; probably sedentary, but thought to be migrant in Nepal. Coveys tend to sit tight, "exploding" into flight when pressed.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Considered safe because of extensive range and occurrence at edges of agricultural land, although not believed to enter standing crops. Little information available on abundance and trends. Distributed throughout India, and has been collected in Nepal; was plentiful in parts of Sri Lanka until 1950's at least.

Bibliography. Alderton (1992), Ali (1979), Ali & Ripley (1980), Baker (1930, 1935), Crowe & Crowe (1985), Henry (1971), Inskipp & Inskipp (1985), Johnsgard (1988), Kaul & Howman (1991), Phillips (1978), Ripley (1982), Sankar et al. (1993), Thornhill (1981).

75. Rock Bush-quail

Perdicula argoondah

French: *Pardicula argoondah* German: *Madraswachtel* Spanish: *Pardicilla Argundá*

Taxonomy. *Coturnix Argoondah* Sykes, 1832, Deccan.

Race *salimalii* has been considered a mere morph. Three subspecies recognized.

Subspecies and Distribution.

P. a. meinertzhageni Whistler, 1937 - NW India S to Kutch and E to W Madhya Pradesh.

P. a. argoondah (Sykes, 1832) - Peninsular India.

P. a. salimalii Whistler, 1943 - S India (EC Karnataka).



Descriptive notes. c. 15-18 cm; 59-74 g. Outermost primary longer than innermost, and inner webs of primaries mottled or barred buff, usually diagnostic; differs from *P. asiatica* by colour pattern of eyestripe and throat. Immature resembles male in having blackish bars, unlike immature *P. asiatica*. Race *meinertzhageni* has paler upperparts; *salimalii* has brick red upperparts.

Habitat. Semi-desert habitats such as dry, open plains littered with thorny bushes; rarely occurs above 600 m.

Food and Feeding. No information available.

Breeding. Seasonality uncertain, but possibly

related to rainfall; generally Aug-Nov and Jan-Mar. Nest situated under a rock or in cover. Lays 5-6 eggs (4-8); incubation 16-18 days, by female alone; chicks have earthy brown down above barred black, fulvous buff below more or less barred blackish brown.

Movements. No information available; probably sedentary. Coveys tend to sit tight, "exploding" into flight when pressed.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Considered to be safe from extinction because of extensive range and fact that species appears to be rather common in scrubby habitats. No information available on numbers and trends. Habitat is being damaged, lost to urbanization and degraded; species is also hunted for food.

Bibliography. Alderton (1992), Ali & Ripley (1980), Baker (1930, 1935), Johnsgard (1988), Raethel (1988), Ripley (1982), Robbins (1981), Zacharias & Gaston (1993).

76. Painted Bush-quail

Perdicula erythrorhyncha

French: *Pardicula à bec rouge* German: *Buntwachtel* Spanish: *Pardicilla Piquirroja*

Taxonomy. *Coturnix erythrorhyncha* Sykes, 1832, Karli Valley, north Konkan. Has been included in genus *Cryptoplectron*. Two subspecies recognized.

Subspecies and Distribution.

P. e. erythrorhyncha (Sykes, 1832) - W Ghats of W India.

P. e. blewitti (Hume, 1874) - C & E India.



Descriptive notes. Nominate *erythrorhyncha* c. 18 cm, 70-85 g; race *blewitti* c. 16 cm, 50-70 g. Outermost primary equal to innermost, and upperparts brown with black spots, diagnostic in combination. Female resembles male but for head pattern. Immature male has less prominent head markings; immature female has blackish crown. Race *blewitti* smaller and paler.

Habitat. Grassland and scrub, forest edge and cultivation; from 600 m to 2000 m.

Food and Feeding. Seeds of grasses and weeds, green plant matter, and termites and other insects.

Breeding. Season poorly defined and nests found in most months, varying according to locality. Nest apparently ill concealed amidst cover and sometimes lined with grass. Lays 4-7 eggs (up to 10); incubation 16-18 days, by female only.

Movements. No information available; probably sedentary. Moves out to feed in more open patches in morning and evening. Coveys tend to sit tight; when pressed, birds fly short distances in different directions.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Considered to be safe because of extensive range and also due to occurrence on margins of agricultural land and in forest edge habitat. No information available on either relative abundance or trends; no specific threats identified to date.

Bibliography. Alderton (1992), Ali (1979), Ali & Ripley (1980), Baker (1930, 1935), Johnsgard (1988), Raethel (1988), Ripley (1982), Robbins (1981), Zacharias & Gaston (1993).

77. Manipur Bush-quail

Perdicula manipurensis

French: *Pardicula de Manipur* German: *Manipurwachtel* Spanish: *Pardicilla de Manipur*
Other common names: Assam Bush-quail

Taxonomy. *Perdicula manipurensis* Hume, 1880, bases of hills in south-eastern Manipur Plain. Has been included in genus *Cryptoplectron*. Two subspecies recognized.

Subspecies and Distribution.

P. m. manipurensis Hume, 1880 - NE India (in hills of Manipur and Assam S of R Brahmaputra) and Bangladesh.

P. m. inglisti (Ogilvie-Grant, 1909) - NE India (in West Bengal and Assam N of R Brahmaputra).



Descriptive notes. c. 19 cm; 64-78 g. Outermost primary equal in length to innermost, and upperparts slaty grey, diagnostic in combination. Immature browner than adult, with heavier black markings. Race *inglisti* has upperparts more faintly marked with black.

Habitat. Very specific habitat requirement: tall, dense grassland, especially of elephant grass, up to c. 1000 m; sometimes around swamps.

Food and Feeding. Seeds of grasses and herbs, pods and some insects.

Breeding. Only one nest reported (*manipurensis*), which had 4 eggs in a hollow scraped in ground among grass roots in May.

Adults (*inglisti*) show signs of breeding at beginning of Mar.

Movements. No information available; probably sedentary. Moves out to feed in burnt grass patches in early morning and afternoon. Flies a short distance when pressed.

Status and Conservation. RARE. Mace-Lande: Endangered. Considered threatened because of very small range and highly fragmented habitat; must be declining in numbers. No recent records from Bangladesh, where few, if any, extensive areas of elephant grass remain, and those that survive are flooded for two thirds of the year; species may, however, still occur in Chittagong Hill Tracts. During late 1940's, it was thought that species might yet prove to inhabit the Chindwin Valley of Burma, but this remains a mere possibility. Species occurs in Assam Plains Endemic Bird Area. Threatened by continuing loss and fragmentation of habitat and some overhunting. An extensive survey is clearly required, concentrating on all known localities, past and present.

Bibliography. Alderton (1992), Ali & Ripley (1980), Baker (1930), Collar & Andrew (1988), Harvey (1990), Johnsgard (1988), Raethel (1988), Ripley (1982), Robbins (1981), Schonwetter (1967), Smythies (1986).

Genus *OPHRYSIA* Bonaparte, 1856

78. Himalayan Quail

Ophrysia superciliosa

French: *Ophrysie de l'Himalaya* German: *Himalayawachtel* Spanish: *Pardicilla Himalaya*
Other common names: Indian/Mountain Quail

Taxonomy. *Rollulus superciliosus* J. E. Gray, 1846, India = Mussoorie. Monotypic.



Distribution. N India: known only from areas around Mussoorie and Naini Tal in Uttar Pradesh. Possibly extinct.

Descriptive notes. c. 25 cm. Long tail and bristle-like feathers on forehead; small white patches in front of and behind eye; body feathers have unusual shape and texture. Female shows distinctive combination of red bill and mostly tawny to cinnamon brown plumage heavily patterned with blackish spots and streaks.

Habitat. Occurs, or occurred, on steep hill-sides, in patches of long grass and brushwood; recorded from c. 1650 m up to c. 2100 m.

Food and Feeding. Grass seeds recorded; probably also berries and insects.

Breeding. No information available.

Movements. No reliable information available. Stated to be a poor flier, covering only short distances when almost stepped upon; contrary to this, however, it has been suggested that the species wintered in N India, moving down from possible breeding grounds farther N. Occurred in coveys of 5-6 birds.

Status and Conservation. Almost certainly EXTINCT. Mace-Lande: Critical/Extinct. Only known from 9-10 specimens, the last of which was collected over 100 years ago. Restricted range; range falls within Western Himalaya Endemic Bird Area. Species possibly very difficult to locate; over last 40 years, there have been several unconfirmed records from the region, but despite various efforts, there is no proof that species survives. Causes of presumed decline and possible extirpation of species remain unknown. A survey of (former) localities is required at appropriate time of year, in attempt to establish whether or not species is still extant; this should include interviews with local human population.

Bibliography. Alderton (1992), Ali (1977, 1979), Ali & Ripley (1980), Baker (1930), Collar & Andrew (1988), Johnsgard (1988), Kaul (1992), Mukherjee (1966), Negi (1992), Raethel (1988), Rieger & Walzhöny (1992), Ripley (1952, 1982), Robbins (1981), Sankaran (1990).

Genus *XENOPERDIX* Dinesen *et al.*, 1994

79. Udzungwa Forest-partridge

Xenoperdix udzungwensis

French: Xénoperdrix de Tanzanie German: Udzungwawachtel Spanish: Perdiz de Udzungwa

Taxonomy. *Xenoperdix udzungwensis* Dinesen *et al.*, 1994, Ndundulu Mountains, in Udzungwa Mountains, Tanzania.

Originally thought to be an aberrant species of forest francolin, but extensive taxonomic study indicates that present species is probably most closely related to the Asiatic genus *Arborophila*; significant similarities include pattern of underwing-coverts, scaling on rear part of tarsus, several general plumage features, tree-roosting habit and whistling calls. Monotypic.

Distribution. S Tanzania, where occurs in two areas within Udzungwa Mts: Ndundulu Mts and Nyumbanitu Mts.



Descriptive notes. c. 29 cm; 3 males 220 g, 222 g and 239 g. Bright red bill, strongly barred upperparts and heavily blotched underparts. Female very similar to male, but (on limited material) has darker crown, more extensive blotching on underparts and larger dark patch on face. Immature undescribed.

Habitat. Montane and submontane evergreen forest between 1350 m and 1900 m; seen on ridges and steep slopes, and also on flatter ground, especially where understory open.

Food and Feeding. Invertebrates such as beetles, ants, flies and woodlice; also seeds. Feeds among leaf litter on forest floor by

scratching and turning over leaves with bill; also picks at low herbs, possibly for insects.

Breeding. Possibly from onset of rains: adult seen with chicks in late Nov and again in early Dec. No further information available.

Movements. No information available.

Status and Conservation. VULNERABLE. Mace-Lande: Vulnerable. Considered vulnerable mainly because of limited range; total known range less than 300 km²; site in Ndundulu Mts is W part of a forest covering 240 km², site in Nyumbanitu Mts covers 55 km². Species discovered after completion of Biodiversity Project; occurs in Eastern Arc Mountains Endemic Bird Area. Frequently encountered; flocks of up to 8 recorded and a total of 246 individuals seen in 85 encounters during 5½ months of fieldwork in 1991-1992. However, recent survey of one of the sites failed to find species, and reported widespread snaring. Ndundulu and Nyumbanitu Mts are within West Kilombero Scarp Forest Reserve; other parts of which are included in Udzungwa Mountains National Park, gazetted in Feb 1992; distribution of species within this park not yet known. Limited distribution makes species vulnerable to habitat alterations.

Bibliography. Anon. (1994), Dinesen *et al.* (1994).

Genus *ARBOROPHILA* Hodgson, 1837

80. Common Hill-partridge

Arborophila torquedula

French: Torquéole à collier

German: Hügelhuhn

Spanish: Arborófila Común

Other common names: Hill Partridge, Necklaced/Indian Hill-partridge

Taxonomy. *Perdix torquedula* Valenciennes, 1826, Bengal.

Four subspecies recognized.

Subspecies and Distribution.

A. t. millardi (Stuart Baker, 1921) - W Himalayas.

A. t. torquedula (Valenciennes, 1826) - Nepal E to Tibet and N Burma.

A. t. batemani (Ogilvie-Grant, 1906) - N Burma and SC China (W Yunnan, SW Sichuan).

A. t. griseata Delacour & Jabouille, 1930 - NW Vietnam.



Descriptive notes. c. 29 cm; 227-430 g. Head pattern distinctive. Female differs mainly on crown and throat; lacks male's head pattern and neck band. Immature male resembles adult, but lacks eyestripe, and has underparts spotted white. Races separated on neck and underpart patterns.

Habitat. Evergreen forest and scrub, usually between 1500 m and 2700 m, but higher in some areas; occurs in particularly heavy hill forest with streams and dense undergrowth.

Food and Feeding. Seeds, shoots, berries, insects and small molluscs. Scratches for food amongst leaf litter.

Breeding. Season Apr-Jul in India, earlier at lower altitudes; Feb-May in race *batemani*. Nest varies from a scrape to a deep cup, lined with grass; one nest of race *millardi* was in a hole scraped out in a bank, domed over with grass. Lays 3-5 eggs (up to 9); incubation apparently 24 days, in captivity; chicks have chestnut and dark brown down on upperparts, pale buff underparts, with a dark brown band on breast.

Movements. No altitudinal movements reported. Prefers to escape by running, but if flushed flies strongly between trees.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Considered fairly common in Nepal. No information on abundance or trends in India, other than that species was reported to be fairly common in Sikkim in 1960's, and likely to be stable in Bhutan. Very common in Burma in late 1940's; considered rare in China. No information available on actual or potential threats, but species probably declining due to habitat loss and degradation; unlikely to be threatened in Bhutan.

Bibliography. Ali (1962), Ali & Ripley (1980), Baker (1930), Cheng Tso-hin (1987), Cheng Tso-hin *et al.* (1978), Davison (1982a), Eichécopar & Hüc (1978), Gaston *et al.* (1993), He Fen-qi *et al.* (1990), Inskipp & Inskipp (1985, 1993a, 1993b), Johnsgard (1988), Katti *et al.* (1992), Kaul & Ahmed (1993), Meyer de Schauensee (1984), Robson (1986), Smythies (1986), Tymstra (1993).

81. Sichuan Hill-partridge

Arborophila rufipectus

French: Torquéole de Boulton

German: Boultonbuschwachtel

Spanish: Arborófila de Sichuan

Other common names: Boulton's Hill-partridge, Sichuan Partridge

Taxonomy. *Arborophila rufipectus* Boulton, 1932, west Sichuan, China.

Sometimes included in proposed superspecies formed by *A. javanica*, *A. orientalis* and *A. brunneopectus*. Monotypic.

Distribution. SC China (S Sichuan, and perhaps also NE Yunnan).



Descriptive notes. 28-30.5 cm; male 410-470 g, female 350-380 g. Distinguished from *A. torquedula* by mainly white throat and russet on breast. Female duller. Immature undescribed.

Habitat. Subtropical evergreen forest and woods, usually between 1000 m and 2000 m.

Food and Feeding. Fruits of *Elaeagnus*, *Eunonymus*, *Rubus* and oaks reported; also some invertebrates.

Breeding. Season Apr-Jun. Nest is a scrape, usually among tree roots. Lays 5-6 eggs. No further information available.

Movements. No information available.

Status and Conservation. ENDANGERED. Mace-Lande: Critical. One of the most threatened of all Galliformes; population estimated at c. 1000 birds, and currently declining, although still said to be locally common; known from five sites in overall area of under 100 km². Not found in any protected area within its tiny range; occurs in South China Forests Endemic Bird Area. Logging is causing both loss and degradation of its habitat, and artificial replanting, especially with monocultures, is also reducing extent of suitable habitat available to species.

Bibliography. Cheng Tso-hin (1987), Cheng Tso-hin *et al.* (1978), Collar & Andrew (1988), Davison (1982a), Eichécopar & Hüc (1978), He Fen-qi (1992), Johnsgard (1988), King, B.F. (1989a, 1989b), Li Gui-yuan *et al.* (1974), McGowan (1994a), Meyer de Schauensee (1984), Raethel (1988).

82. Chestnut-breasted Hill-partridge

Arborophila mandellii

French: Torquéole de Mandell

Spanish: Arborófila Pechirroja

German: Rothrust-Buschwachtel

Other common names: Red-breasted Hill-partridge, Chestnut-breasted Partridge

Taxonomy. *Arborophila Mandellii* Hume, 1874, Bhutan Duars.

Monotypic.

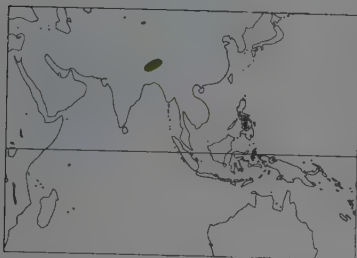
Distribution. NE India (Arunachal Pradesh and Sikkim) through Bhutan to SE Tibet.

Descriptive notes. c. 28 cm; c. 268 g. Bright pattern on head and neck distinctive. Immature undescribed.

Habitat. Believed to inhabit evergreen forest undergrowth at 350-2500 m.

Food and Feeding. No information available.

Breeding. Believed to be Mar-Jun in Tibet. One nest reported, 4 eggs in oak/rhododendron forest at 2400 m in Sikkim.



Movements. No altitudinal movement reported.

Status and Conservation. Not globally threatened. Mace-Lande: Vulnerable. Currently considered near-threatened. Very little information available on status in wild; only recent records are from 2-3 sites in Arunachal Pradesh, and some possible records from Bhutan. Status inferred from condition of habitat, which may always have been fragmented throughout its limited range; occurs in Eastern Himalaya Endemic Bird Area. Threats are mainly pressures on presumed habitat, through felling of trees and slash-and-burn agriculture; hunting for food may be a problem in some areas. Survey work is clearly required.

Bibliography. Ali (1962), Ali & Ripley (1980), Baker (1930), Cheng Tso-hin (1987), Davison (1982a), Inskipp & Inskipp (1993b), Johnsgard (1988), Meyer de Schauensee (1984), Raethel (1988), Ripley (1982), Smythies (1986).

83. Collared Hill-partridge

Arborophila gingica

French: Torquéole de Gingi **German:** Chinabuschwachtel **Spanish:** Arborófila de Fujián
Other common names: White-necklaced/Rickett's/Fokien Hill-partridge, Rickett's Partridge

Taxonomy. *Tetrao gingicus* Gmelin, 1789, "Gingi in Coromandel"; error = south-east China. Monotypic.

Distribution. SE China, from SW Zhejiang S to Guangdong and E Guangxi.



Descriptive notes. c. 25-30 cm; one individual 253 g. Striking head pattern; combination of black, white and chestnut bands across upper breast separates from all congeners. Female somewhat smaller; resembles male but has chestnut and white undertail-coverts. Immature has greyer eyestripe.

Habitat. Dense broad-leaved and mixed broad-leaved and coniferous forests in hills and mountains, occurring at 500-1700 m.

Food and Feeding. Seeds, berries and insects reported.

Breeding. Probably lays Apr-May; 5-7 eggs. **Movements.** No information available.

Status and Conservation. RARE. Mace-Lande: Endangered. Little detailed information available, but still said to be locally common; occurs in several protected areas; logging is fragmenting and reducing extent of suitable habitat, and population now probably numbers fewer than 10,000 individuals; currently considered rare throughout most of range, which has a dense human population. Species has restricted range; occurs in Fujian Mountains Endemic Bird Area.

Bibliography. Cheng Tso-hin (1987), Cheng Tso-hin *et al.* (1978), Collar & Andrew (1988), Davison (1982a), Eichécopar & Hùe (1978), Hui, Ming & Tian (1993), Johnsgard (1988), Kang (1969), Li Xiao-Hui *et al.* (1990, 1992), Meyer de Schauensee (1984), Raethel (1988).

inches

8
20

ssp intermedia

ssp guttata

ssp rufogularis

ssp annamensis

ssp campbelli

ssp rolli

ssp orientalis

ssp albigula

ssp brunnepectus

ssp henrici

grey-browed individual

ssp hyperythra

ssp erythrophrys

birds
showing
variation
in head
pattern



84. Rufous-throated Hill-partridge

Arborophila rufogularis

French: Torquéole à gorge rousse

German: Rotkehl-Buschwachtel

Spanish: Arborófila Golirufa

Other common names: Rufous-throated Partridge

Taxonomy. *Arboricola rufogularis* Blyth, 1850, Darjeeling, north-east India.

Proposed race *laotiana* not generally accepted; instead included within race *guttata*. Six subspecies normally recognized.

Subspecies and Distribution.

A. r. rufogularis (Blyth, 1850) - N India (from Uttar Pradesh E to Assam) and Nepal.

A. r. intermedia (Blyth, 1856) - NE India (Assam S of R Brahmaputra) E to Burma (Arrakan Yomas).

A. r. tickelli (Hume, 1880) - E & S Burma (from South Shan to Tenasserim) E to Thailand and SW Laos.

A. r. euroa (Bangs & Phillips, 1914) - SC China (SE Yunnan) to N Laos.

A. r. guttata Delacour & Jabouille, 1928 - C Vietnam.

A. r. annamensis (Robinson & Kloss, 1919) - SC Vietnam.



Descriptive notes. c. 28 cm; 200-300 g (*rufogularis*), 340-370 g (males of *intermedia*). Head and throat pattern distinctive. Female rather similar to male, but has less black on chin and throat, and more white spots on underparts; crown browner. Immature duller, with more white spots below. Races vary most conspicuously in head and throat pattern.

Habitat. Occurs in evergreen forest with thick undergrowth, from 300 m up to 2600 m; also found in areas of bamboo, scrub and heavy secondary growth.

Food and Feeding. Seeds, berries, green plant matter and invertebrates reported.

Breeding. Season Apr-Aug, mainly May-Jun. Nest is either simply a scrape, or can have a dome of grass and a small entrance hole; in both cases, sited in grass. Lays 4-5 eggs (up to 8); incubation c. 20-21 days; chicks have chocolate brown down above, brownish cream below, with dark breast and flanks.

Movements. No altitudinal movement reported. Prefers to escape from potential danger by running, rather than flying.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Considered safe mainly because of large range, but situation may be more serious than currently believed. Species is scarce resident in Nepal, where numbers are declining such that it is considered in danger of extinction in this country. In India, no recent information, but both *rufogularis* and *intermedia* were formerly considered locally common. Widely distributed in Burma up to 1940's at least, but rare below 900 m and absent or very rare in many areas. No recent records from Bangladesh where may formerly have been resident; may still occur in hill forest in Chittagong Hill Tracts of NE. Probably still widespread but scarce in much of N Thailand. Main threats are those to habitat, e.g. in Nepal and Thailand; overhunting also believed to be a problem throughout much of range.

Bibliography. Ali & Ripley (1980), Baker (1928, 1930), Cheng Tso-hin (1987), Cheng Tso-hin *et al.* (1978), Davison (1982a), Deignan (1945), Etchécopar & Hùe (1978), Harvey (1990), Inskipp (1989), Inskipp & Inskipp (1985, 1993b), Johnsgard (1988), Lekagul & Round (1991), Meyer de Schauensee (1984), Robson *et al.* (1993a, 1993b), Round (1988), Sarker (1986), Smythies (1986), Tang Chan-zhu (1990).

85. White-cheeked Hill-partridge

Arborophila atrogularis

French: Torquéole à joues blanches

German: Wei Wangen-Buschwachtel

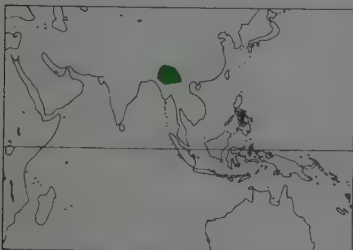
Spanish: Arborófila Cariblanca

Other common names: White-cheeked Partridge

Taxonomy. *Arboricola atrogularis* Blyth, 1850, Assam, Sylhet and Arrakan.

Monotypic.

Distribution. NE India (Assam), Bangladesh, N Burma and SC China (W Yunnan).



Descriptive notes. c. 28 cm; 200-312 g. Distinctive head and neck pattern distinguishes from most congeners; grey and brown crown separates from some similar forms of *A. orientalis*. Female generally similar to male, but has yellower tarsus. Immature apparently undescribed.

Habitat. Occurs from foothills up to 1500 m in evergreen forest, scrub and bamboo; even found in grassland and cultivation adjacent to forest cover.

Food and Feeding. Very little information available. Believed to feed on seeds of weeds, as well as berries, shoots and assorted invertebrates.

tebrates.

Breeding. Laying Mar-Apr in India at lower altitudes, Jun-Jul higher up; timing of season not known elsewhere. Nest is a scrape situated under scrub in grassland or bamboo, usually lined with grass and leaves. Usually 4-5 eggs (3-7).

Movements. No information on any seasonal movements, but species may well be simply rare visitor to Bangladesh. When a covey is pressed, birds flush one at a time.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Currently considered near-threatened. Considered safe mainly because of fairly large range, but situation may be more serious than is anticipated at present. In India, no recent information, but formerly considered to be commoner

at lower altitudes, which may now be more disturbed. Several records from estates in NE Bangladesh, but now believed only rare visitor where once was more frequent; may still occur in SE hill forest. Common in foothills below 1300 m in Burma up to 1940's at least, but no recent information. Quite rare within its very small range in SC China. Main threats are to its habitat, especially as it inhabits lower slopes of hills. More detailed and up-to-date information is required on this species.

Bibliography. Ali & Ripley (1980), Baker (1930), Cheng Tso-hin (1987), Cheng Tso-hin *et al.* (1978), Davison (1982a), Harvey (1990), Johnsgard (1988), Meyer de Schauensee (1984), Morioka (1957), Ræthel (1988), Ripley (1982), Sarker (1986), Smythies (1986).

86. Taiwan Hill-partridge

Arborophila crudigularis

French: Torquéole de Formose

German: Taiwanbuschwachtel

Spanish: Arborófila de Formosa

Other common names: Formosan Hill-partridge, Taiwan Partridge

Taxonomy. *Oreoperdix crudigularis* Swinhoe, 1864, mountains of Taiwan.

Monotypic.

Distribution. Mountains of Taiwan.



Descriptive notes. c. 28 cm; one male 311 g, female c. 212 g. Distinctive head and neck pattern, showing more extensive white on face than most other *Arborophila* that have grey underparts; similar to some forms of *A. orientalis*, but always has paler crown, and tends to be more boldly marked on upperparts. Female has more white spotting below, especially on flanks, and fewer black markings on throat. Immature plumage apparently undescribed.

Habitat. Temperate primary broad-leaved and possibly mixed forest between 1500 m and 2000 m.

Food and Feeding. Seeds, berries, seedlings,

leaves and invertebrates reported.

Breeding. Season from late Feb to Aug. Nest situated in crevice amongst boulders, or hidden at base of tree. Lays 6-8 eggs; incubation reported to last 24 days, but only 20-21 in captivity.

Movements. No information available.

Status and Conservation. Not globally threatened. Mace-Lande: Vulnerable. Formerly widespread at suitable altitudes, but few records in recent years. Overall population likely to number less than 10,000 birds; species declining outside protected areas, but probably stable within them. Known from Taroko, Hsieh-Ba and Yushan National Parks, Yu-Li, Chu-yun Shan, Nanao Lake and Hardwood and Tsuifeng Lake Wildlife Nature Reserves. Species has restricted range; occurs in Taiwan Endemic Bird Area. Main pressures are those on habitat, which is in process of being reduced by tree-felling and conversion to agricultural land.

Bibliography. Cheng Tso-hin (1987), Cheng Tso-hin *et al.* (1978), Davison (1982a), Etchécopar & Hue (1978), Johnsgard (1988), Meyer de Schauensee (1984), Morioka (1957), Ræthel (1988), Schenck *et al.* (1967), Severinghaus & Blackshaw (1976), Tang Chan-zhu (1990).

87. Hainan Hill-partridge

Arborophila ardens

French: Torquéole de Hainan German: Hainanbuschwachtel Spanish: Arborófila de Hainán

Other common names: White-eared Hill-partridge, Hainan Tree-partridge/Partridge

Taxonomy. *Arboricola ardens* Styan, 1892, Liuowowan, Hainan Island.

Monotypic.

Distribution. Mountains of Hainan, S China. May occur in S Guangxi.



Descriptive notes. c. 28 cm; one male 300 g, one female 237 g. Distinctive bright reddish orange necklace contrasts vividly with mostly black head offset by white spot on ear-coverts. Female similar to male, but paler below. Immature apparently similar to adult, but lacks reddish necklace.

Habitat. Inhabits evergreen tropical forests and woods between 750 m and 1200 m.

Food and Feeding. No information available, other than that tree seeds and snails have been recorded in diet.

Breeding. No information available.

Movements. No information available.

Status and Conservation. ENDANGERED. Mace-Lande: Endangered. Considered to be threatened because very little suitable habitat remains, with forest cover on Hainan reduced from c. 8630 km² to 2420 km²; population probably numbers much less than 10,000 individuals: known from five localities, including Ba Wang Ling and Wuzhishan Nature Reserves. Restricted range; occurs in Hainan Endemic Bird Area. Apparently common in Ba Wang Ling Nature Reserve, although the level of protection that this affords is uncertain. Threats are those to habitat, especially extraction of trees, conversion to agricultural land and general degradation; species is also hunted.

Bibliography. Cheng Tso-hin (1987), Cheng Tso-hin *et al.* (1978), Collar & Andica (1988), Davison (1982a), Etchécopar & Hue (1978), Johnsgard (1988), Meyer de Schauensee (1984), Morioka (1957), Ræthel (1988).

88. Chestnut-bellied Hill-partridge

Arborophila javanica

French: Torquéole de Java

German: Javabuschwachtel

Spanish: Arborófila de Java

On following pages: 89. Grey-breasted Hill-partridge (*Arborophila orientalis*); 90. Brown-breasted Hill-partridge (*Arborophila brunneopectoris*); 91. Orange-necked Hill-partridge (*Arborophila davidi*); 92. Chestnut-headed Hill-partridge (*Arborophila cambodiana*); 93. Bornean Hill-partridge (*Arborophila hyperythra*); 94. Red-billed Hill-partridge (*Arborophila rubrirostris*).

Other common names: Javan Hill-partridge, Chestnut-bellied Partridge

Taxonomy. *Tetrao javanicus* Gmelin, 1789, Java.

Some authors include present species in a superspecies with *A. orientalis* and *A. brunneopectus*, and all three are sometimes considered conspecific; others attribute morphological similarities to convergent evolution; sometimes *A. rufipectus* or *A. hyperythra*, or both, also included in the superspecies. Three subspecies recognized.

Subspecies and Distribution.

- A. f. javanica* (Gmelin, 1789) - mountains of W Java.
A. f. bartelsi Siebers, 1929 - mountains of WC Java.
A. f. lavuana Bartels, 1938 - mountains of EC Java.



Descriptive notes. c. 28 cm; 257-286 g. One of most distinctive *Arborophila*, quite dissimilar to any of congeners. Female as male. Immature has white throat, dark brown breast and some white spots on scapulars. Races vary essentially in head pattern.

Habitat. Forest between 300 m and 3000 m.

Food and Feeding. No information available.

Breeding. Season apparently extended, with records from Jan-Apr and Jul-Nov. Lays up to 4 eggs. No further information available.

Movements. No information available.

Status and Conservation. Not globally threatened. Mace-Lande: Vulnerable. Little direct

information; species considered threatened due to habitat loss, and forest clearance has probably led to extinction from lower elevations. Restricted range; occurs in Javanese and Balinese Mountains Endemic Bird Area. Species occurs in several protected areas of various categories, some of which are very small. Still common on Gunung Gede-Pangrango and on Gunung Halimun. Main problems are loss, degradation and resultant fragmentation of habitat; some trapping for bird trade poses additional threat. Not protected by Indonesian law.

Bibliography. Andrew (1985, 1992), van Balen (1992), Davison (1982a), Hellebrekers & Hoogerwerf (1967), Holmes (1989), Johnsgard (1988), MacKinnon (1988), MacKinnon & Phillips (1993), Raethel (1988), Schönwetter (1967), Wells (1985).

89. Grey-breasted Hill-partridge

Arborophila orientalis

French: Torquéole de Sumatra

Spanish: Arborófila de Sumatra

German: Sumatrabuschwachtel

Other common names: Bare-throated Hill-partridge, Grey-breasted Partridge; Campbell's Hill-partridge (*campbelli*)

Taxonomy. *Perdix orientalis* Horsfield, 1821, Blambangan, east Java.

Some authors include present species in a superspecies with *A. javanica* and *A. brunneopectus*, and all three are sometimes considered conspecific; others attribute morphological similarities to convergent evolution; sometimes *A. rufipectus* or *A. hyperythra*, or both, also included in the superspecies. Race *campbelli* sometimes considered to constitute separate species. Four subspecies normally recognized.

Subspecies and Distribution.

- A. o. campbelli* (Robinson, 1904) - mountains of Peninsular Malaysia.
A. o. rolli (Rothschild, 1909) - Batak Highlands, N Sumatra.
A. o. sumatrana Ogilvie-Grant, 1891 - mountains of C Sumatra.
A. o. orientalis (Horsfield, 1821) - mountains of E Java.



Descriptive notes. c. 28 cm; c. 268 g. Head shows distinctive patterns in black and white, varying with race. Female has duller black on head. Immature has pale shaft streaks, is usually more rufous below, and has some barring on breast. Racial variation considerable, mainly in head pattern and underpart coloration, and also in presence or absence of bold markings on underparts.

Habitat. Primary forest, mainly upper dipterocarp, lower montane and tall upper montane forest, between 500 m and 2200 m; altitude limits vary according to locality.

Food and Feeding. Diet includes palms, *Pra-*

tia berries and invertebrates, especially termites and snails.

Breeding. One clutch of 2 eggs found in Mar, at base of palms in Selangor, Malaysia; another nest with 4 eggs also reported. No further information available.

Movements. No information available.

Status and Conservation. Not globally threatened. Mace-Lande: *orientalis* vulnerable; *campbelli* vulnerable. Only recent information available on *orientalis* comprises reports from 3 sites, Meru Betiri National Park, and Yang Highlands and Ijen Crater Nature Reserves; only a small part of the first two includes suitable habitat. Other races are respectively believed to be sparsely distributed in suitable habitat in Malaysia, and common in Sumatra; both zones may hold the species at undocumented sites in mountains where habitat is not threatened. Population thought to be declining slightly. Not protected by Indonesian law. Directly exploited for food and for bird trade in some areas. CITES III in Malaysia.

Bibliography. van Balen (1992), Davison (1982a), Davison & Scriven (1987), Gibson-Hill (1949, 1952), Holmes (1989), Johnsgard (1988), MacKinnon (1988), MacKinnon & Phillips (1993), van Marle & Voois (1988), Medway & Wells (1976), Robinson & Chasen (1936), Robinson & Kloss (1921, 1924), Wells (1985).

90. Brown-breasted Hill-partridge

Arborophila brunneopectus

French: Torquéole à poitrine brune

German: Braunbrust-Buschwachtel

Spanish: Arborófila Pechiparda

Other common names: Bar-backed/Barred Hill-partridge, Brown-breasted Partridge

Taxonomy. *Arboricola brunneopectus* Blyth, 1855, Muleyit, Tenassarim.

Some authors include present species in a superspecies with *A. javanica* and *A. orientalis*, and all three are sometimes considered conspecific; others attribute morphological similarities to convergent evolution; sometimes *A. rufipectus* or *A. hyperythra*, or both, also included in the superspecies. Birds of Guangxi (CS China) probably belong to race *henrici*, but sometimes ascribed to nominate race. Three subspecies recognized.

Subspecies and Distribution.

A. b. brunneopectus (Blyth, 1855) - CS China (SW Yunnan) through E Burma and N Laos to W Thailand.

A. b. henrici (Oustalet, 1896) - N & C Vietnam; probably also CS China (Guangxi).

A. b. albigula (Robinson & Kloss, 1919) - SC Vietnam.

Possible occurrence and distribution in C & S Laos uncertain; also race, or races, involved.



Descriptive notes. c. 28 cm; male c. 317 g, female c. 268 g. Barring on back, greyish brown or brown breast, and black and white spots on flanks are distinctive in combination. Female similar to male. Immature has pink to orange legs. Races separated mainly on coloration of head and neck, and also on flank markings.

Habitat. Evergreen forests up to 1350 m, or even as high as 1800 m, depending on locality.

Food and Feeding. No information available.

Breeding. Only nest record is from early Jun, near Rangoon, Burma: 4 eggs in a scrape well filled with bamboo leaves and grass, in open

bamboo. No further information available.

Movements. No information available.

Status and Conservation. Not globally threatened. Mace-Lande: *brunneopectus* safe; *albigula*/*henrici* vulnerable. Nominate *brunneopectus* considered widespread in 1940's, but currently considered vulnerable in Thailand, and rare in SW Yunnan (China), so may be in need of attention. Races *albigula* and *henrici* occupy restricted range in both Vietnam, where little habitat remains, and China. Recently *albigula* recorded at six sites on Da Lat and Di Linh Plateaux, and *henrici* from Bach Ma National Park, all in Vietnam; *albigula* not reported from any protected area. Continuous reduction and fragmentation of habitat is major problem; species is also hunted for food.

Bibliography. Baker (1928), Cheng Tso-hin (1987), Davison (1982a), Deignan (1945), Delacour & Jabouille (1931), Eames *et al.* (1992), Etchécopar & Hüe (1978), Johnsgard (1988), Lekagul & Round (1991), Meyer de Schauensee (1984), Robson *et al.* (1989, 1993a, 1993b), Schönwetter (1967), Smythies (1986), Tang Chan-zhu (1990), Williamson (1918).

91. Orange-necked Hill-partridge

Arborophila davidi

French: Torquéole de David

German: Davidbuschwachtel

Spanish: Arborófila de David

Other common names: Orange-breasted/David's Hill-partridge, Orange-necked Partridge

Taxonomy. *Arborophila davidi* Delacour, 1927, at c. 250 m. Phurieng, 60 km east of Saigon (Ho Chi Minh), Cochinchina.

Monotypic.

Distribution. S Vietnam.



Descriptive notes. c. 28 cm; c. 241 g. Pattern of head and neck, together with bold black and white barring on flanks, present rather distinctive combination. Female and immature undescribed.

Habitat. Only known from areas of dense vegetation, including wooded country in rolling hills, and non-thorny bamboo forest up to 10 m tall. Occurs between 200 m and 250 m.

Food and Feeding. No information available.

Breeding. No information available.

Movements. No information available.

Status and Conservation. INDETERMINATE. Mace-Lande: Endangered. Only known

from type specimens collected in 1927, until recently when seen twice in 3 days in Nam Bai Cat Tien National Park. Failure to find species at other sites and limited extent of habitat available may indicate a population in the hundreds. Restricted range; occurs in Cochinchina Endemic Bird Area. Lack of information makes it difficult to assess threats, but degradation and loss of lowland habitats are likely to have affected the species adversely.

Bibliography. Collar & Andrew (1988), Davison (1982a), Delacour (1927), Delacour & Jabouille (1931), Delacour *et al.* (1927), Eames *et al.* (1992), Johnsgard (1988), Raethel (1988), Robson *et al.* (1993b), Wildash (1968).

92. Chestnut-headed Hill-partridge

Arborophila cambodiana

French: Torquéole du Cambodge

Spanish: Arborófila de Camboya

German: Kambodscha-Buschwachtel

Other common names: Rufous-faced Hill-partridge, Chestnut-headed Partridge

Taxonomy. *Arborophila cambodiana* Delacour & Jabouille, 1928, 1000 m, Bokor, Kampuchea. Race *diversa* might merit treatment as separate species. Two subspecies recognized.

Subspecies and Distribution.

A. c. diversa Riley, 1930 - SE Thailand.

A. c. cambodiana Delacour & Jabouille, 1928 - SW Kampuchea.

Descriptive notes. c. 29 cm; male c. 318 g, female c. 257 g. Mantle and upper back broadly barred black is best distinction from *A. hyperythra*. Female similar to male, but smaller; pattern more variable in female, which sometimes has heavier barring above. Immature probably less spotted below. Race *diversa* has duller face with more marked eyeline, and black and white scaling extending onto belly.

Habitat. Occurs in tropical evergreen forest on mountains, above 700 m.

Food and Feeding. No information available.

Breeding. No information available.

Movements. No information available.



Status and Conservation. RARE. Mace-Lande: *cambodiana* vulnerable; *diversa* endangered. Nominate *cambodiana* is very poorly known; endemic to Cardammon and Elephant Mts from where there is no recent ornithological information; assumed to be declining as consequence of habitat loss. Race *diversa* known only from Namtok Phliu National Park and Khao Soi Dao Wildlife Sanctuary; numbers probably in low hundreds and still declining. Main threats throughout range are likely to be habitat destruction and over-exploitation for food.

Bibliography. Collar & Andrew (1988), Davison (1982a), Delacour & Jabouille (1931), Johnsgard (1988), King *et al.* (1975), Lekagul & Cronin (1974), Lekagul & Round (1991), Raethel (1988), Riley (1938), Round (1988).

93. Bornean Hill-partridge

Arborophila hyperythra

French: Torquéole de Bornéo

German: Borneobuschwachtel

Spanish: Arborófila de Borneo

Other common names: Bornean Partridge/Tree-partridge; Red-breasted Hill-partridge (*hyperythra*); Kinabalu Hill-partridge (*erythrophrys*)

Taxonomy. *Bambusicola hyperythra* Sharpe, 1879, Lawas River, Borneo.

Sometimes included in proposed superspecies formed by *A. javanica*, *A. orientalis* and *A. brunneopectus*. Race *erythrophrys* has been considered to merit treatment as separate species. Two subspecies recognized.

Subspecies and Distribution.

A. h. hyperythra (Sharpe, 1879) - mountains of NC Borneo.

A. h. erythrophrys (Sharpe, 1890) - Mt Kinabalu, Sabah (NE Borneo).



Descriptive notes. c. 25 cm; c 270 g. Rich reddish face and breast distinctive, as is pattern on flanks, mainly black with white spotting. Best separated from rather similar *A. cambodiana* by generally paler, more faintly marked upperparts, and more prominent dark eyeline. Female similar to male, but has smaller, browner spots on flanks. Immature undescribed. Race *erythrophrys* has more elaborate pattern on head; birds from Sarawak variable, sometimes showing extensive grey on supercilium and even down onto cheeks, as well as a darker breast.

Habitat. Montane forest of various types in Kalimantan, including primary lower montane forest between c. 1200 m and 1800 m; also found down to c. 600 m. Apparently associated with bamboo and thickets in forest.

Food and Feeding. Diet includes acorns and variety of other seeds, fruits, grubs, termites, beetles, crickets and ants.

Breeding. Nest is domed, with a hole at the side c. 2-3 cm above the ground. No further information available.

Movements. No information available.

Status and Conservation. Not globally threatened. Mace-Lande: Vulnerable. Few recent records, such as that from Ulu Barito in Kalimantan, a southward range extension; also known from Gunung Mulu National Park in Sarawak, and Kinabalu National Park in Sabah. Likely, however, to occur throughout suitable habitat in mountains of Borneo; reported to be common in Kelabit Highlands of NE Kalimantan and neighbouring Sarawak. Restricted range; occurs in Borneo Mountains Endemic Bird Area. Habitat is being lost and degraded as result of logging; possibly overhunted for food and sport in Kalimantan.

Bibliography. Andrew (1992), van Balen (1992), Davison (1980c, 1982), Dutson (1990), Holmes (1989), Johnsgard (1988), MacKinnon & Philipps (1993), Raethel (1988), Smythies (1957, 1981), Wells (1985), Wilkinson *et al.* (1991a, 1991b).

94. Red-billed Hill-partridge

Arborophila rubrirostris

French: Torquéole à bec rouge

German: Rotschnabel-Buschwachtel

Spanish: Arborófila Piquirroja

Other common names: Red-billed Tree-partridge/Partridge

Taxonomy. *Pelopendix rubrirostris* Salvadori, 1879, Mount Singgalang, Sumatra. Monotypic.

Distribution. Mountains of Sumatra.



Descriptive notes. c. 28 cm; male c. 243 g, female c. 209 g. Very distinctive flank pattern, all black with thin white bars; red bill and eye-ring also characteristic. Amount of white on head very variable, especially on throat, with N populations normally showing more white than those of S; incipient white supercilium. Female like male, but on average has more white on lores and chin.

Habitat. Montane forest, and even scrub in pine forest; occurs between 900 m and 2500 m; possibly prefers steep gullies.

Food and Feeding. No information available.

Breeding. No information available.

Movements. No information available.

Status and Conservation. Not globally threatened. Mace-Lande: Vulnerable. Only known from three areas in Sumatra, but suitable habitat is still apparently widespread in mountains of Sumatra. Montane habitat is relatively secure at present and numbers may be stable. Restricted range; occurs in Sumatra and Peninsular Malaysia Endemic Bird Area. Threats to habitat represent a problem only in some areas. Not protected by Indonesian law.

Bibliography. Andrew (1992), van Balen (1992), Davison (1982a), Holmes (1989), Johnsgard (1988), van Marle & Voous (1988), Meyer de Schauensee & Ripley (1940), Raethel (1988), Robinson & Kloss (1918, 1924), Wells (1985).



95. Green-legged Hill-partridge

Arborophila chloropus

French: Torquéole des bois **German:** Grünfuß-Buschwachtel **Spanish:** Arborófila Pativerde
Other common names: Scaly-breasted/Woodland Hill-partridge, Green-legged Tree-partridge/Partridge

Taxonomy. *Tropicoperdix chloropus* Blyth, 1859, mountains of Tenasserim, Burma = Muleyit. Sometimes placed in genus *Tropicoperdix*. Probably forms superspecies with *A. merlini* and *A. charltonii*, but taxonomy of these three forms poorly understood and requires revision; present species has been considered a race of *A. charltonii*; race *tonkinensis* appears to be intermediate, and may actually belong with *A. charltonii*. Five subspecies currently recognized.

Subspecies and Distribution.

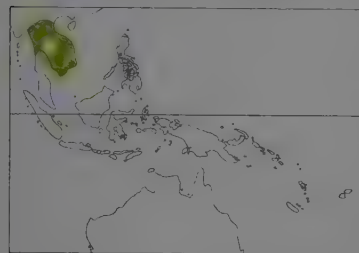
A. c. chloropus (Blyth, 1859) - SC China (S Yunnan) S to Burma (S to N Tenasserim) and W Thailand.

A. c. peninsularis Meyer de Schauensee, 1941 - SW Thailand.

A. c. tonkinensis (Delacour, 1927) - N Vietnam.

A. c. olivacea (Delacour & Jabouille, 1928) - Laos and Kampuchea.

A. c. cognacqi (Delacour & Jabouille, 1924) - S Vietnam.



Descriptive notes. c. 30 cm; 250-300 g. Green legs distinctive. Differs from very similar *A. merlini* in having brighter rufous area on breast, less distinct markings on flanks and lower breast, and green legs; lacks thin black line at base of neck and reddish ear-coverts of *A. charltonii*. Female as male. No information available on immature plumage. Races separated mainly on breast colouring; race *tonkinensis* (possibly pertaining to *A. charltonii*) is intermediate in plumage between present species and *A. charltonii*.

Habitat. Inhabits dense primary forest, but apparently also sometimes found in secondary

forest up to 1400 m; occurs in both evergreen and mixed deciduous forest, as well as patches of bamboo.

Food and Feeding. Seeds, berries and termites reported in diet.

Breeding. Single record of 3 eggs found in May, apparently of race *olivacea*. No further information available.

Movements. No information available.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Little detailed information available. Believed to number in low hundreds of thousands in Thailand, where still said to be common; rare in Yunnan (China); only scattered records from N Burma from 1940's; race *tonkinensis* locally quite common and known from at least three protected areas, but possibly threatened. In Thailand, populations considered more or less stable in protected areas, but declining elsewhere through deforestation and overhunting.

Bibliography. Cheng Tso-hin *et al.* (1978), Davison (1982a), Deignan (1945), Delacour & Jabouille (1931), Gibson-Hill (1952), Johnsgard (1988), Lekagul & Round (1991), Meyer de Schauensee (1984), Ruetzel (1988), Riley (1938), Robinson & Kloss (1921, 1924), Robson *et al.* (1989, 1993a, 1993b), Smythies (1985).

96. Annam Hill-partridge

Arborophila merlini

French: Torquéole de Merlin **German:** Gelbfuß-Buschwachtel **Spanish:** Arborófila de Annam
Other common names: Annamese Hill-partridge, Annam Tree-partridge/Partridge

Taxonomy. *Tropicoperdix merlini* Delacour & Jabouille, 1924, Mailanh, Quangtr, Vietnam. Sometimes placed in genus *Tropicoperdix*. Probably forms superspecies with *A. chloropus* and *A. charltonii*, but taxonomy of these three forms poorly understood and requires revision; present species has been considered a race of *A. charltonii*. Two subspecies currently recognized.

Subspecies and Distribution.

A. m. merlini (Delacour & Jabouille, 1924) - interior of C Vietnam.

A. m. vivida (Delacour, 1926) - coastal hills of C Vietnam.



Descriptive notes. c. 30 cm. Very similar to *A. chloropus*, from which differs most conspicuously in yellowish legs and in much more distinct black scaling on flanks and lower breast. Female apparently as male. No information available on immature plumage. Race *vivida* differs only slightly from nominate.

Habitat. A lowland forest specialist, occurring below 600 m.

Food and Feeding. No information available.

Breeding. No information available.

Movements. No information available.

Status and Conservation. ENDANGERED.

Mace-Lande: Endangered. Very little information

available on status and trend; species possibly declining as result of habitat loss and degradation. Known from Bach Ma National Park, where thought to be common in 1990. Restricted range; occurs in Annamese Lowlands Endemic Bird Area.

Bibliography. Davison (1982a), Delacour & Jabouille (1931), Johnsgard (1988), Robson *et al.* (1993a, 1993b).

97. Chestnut-necklaced Hill-partridge

Arborophila charltonii

French: Torquéole à poitrine châtain **Spanish:** Arborófila Pechicastaña
German: Charltonbuschwachtel

Other common names: Chestnut-breasted Hill-partridge(!), Chestnut-necklaced Tree-partridge/Partridge

Taxonomy. *Perdix charltonii* Eyton, 1845, Malacca.

Sometimes placed in genus *Tropicoperdix*. Probably forms superspecies with *A. chloropus* and *A. merlini*, both of which have been considered races of present species; taxonomy of these three forms poorly understood and requires revision; *A. chloropus tonkinensis* appears to be intermediate, and may actually belong with present species; validity of race *atjenensis* has been questioned. Three subspecies currently recognized.

Subspecies and Distribution.

A. c. charltonii (Eyton, 1845) - S Thailand and S Burma to Peninsular Malaysia.

A. c. atjenensis Meyer de Schauensee & Ripley, 1940 - Aceh, N Sumatra; old records from S Sumatra.

A. c. graydoni (Sharpe & Chubb, 1906) - Sabah, NE Borneo.



Descriptive notes. 28-30 cm. Differs from apparently closely related *A. chloropus* and *A. merlini* by generally brighter plumage, especially chestnut band on upper breast, and tawny belly; reddish patch on ear-coverts; yellow legs. Female similar to male. Immature duller with more dark barring on upperparts. Races differ mainly in face and wing patterns, and in intensity of chestnut on breast band.

Habitat. Inhabits primary lowland forest up to about 300 m; also found at times in heavily disturbed forest.

Food and Feeding. Seeds, berries and termites reported in diet.

Breeding. No reliable information available.

Movements. No information available.

Status and Conservation. RARE. Mace-Lande: *charltonii* endangered; *graydoni* endangered; *atjenensis* critical. Nominote *charltonii* possibly numbers fewer than 1000 individuals, an estimate based on extent of lowland forest remaining; reported from quite disturbed sites in S Thailand, where may be on verge of extinction. Race *graydoni* may number in low hundreds, with decline as result of habitat destruction on massive scale; reported to be moderately common in logged forest in Sabah; recorded recently only from Danum Valley, but may occur elsewhere. Race *atjenensis* known only from extreme N Sumatra, and probably also from S Sumatra; not reported from any protected area, but may occur in NE Gunung Leuser National Park; some of formerly suitable habitat in S Sumatra has been completely deforested; no recent records from anywhere in Sumatra, and may survive only in N; large-scale habitat destruction implies population in low hundreds. Extensive habitat loss threatens all 3 races, and surveys are urgently required to establish where species survives, and extent of suitable habitat that remains. Not protected by Indonesian law. CITES III in Malaysia.

Bibliography. van Balen (1992), Chasen (1939), Collar & Andrew (1988), Davison (1982a), Davison & Scriven (1987), Gibson-Hill (1949), Holmes (1989), Johns (1986, 1989), Johnsgard (1988), Lekagul & Round (1991), MacKinnon & Philipps (1993), van Marle & Voous (1988), Medway & Wells (1976), Robinson (1913, 1915a, 1915b), Robinson & Kloss (1921), Schönewetter (1967), Smythies (1957, 1981, 1986), Wells (1985).

Genus CALOPERDIX Blyth, 1861

98. Ferruginous Wood-partridge

Caloperdix oculea

French: Rouloul ocellé **German:** Augenwachtel **Spanish:** Perdicilla Herrumbrosa
Other common names: Ferruginous Partridge

Taxonomy. *Perdix oculea* Temminck, 1815, India.

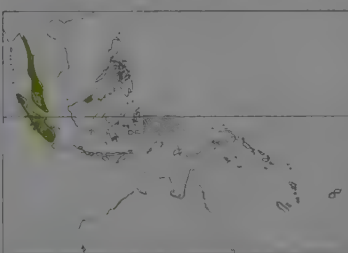
Sumatran birds have traditionally been placed in race *sumatrana*, but name *ocellata* has priority. Three subspecies recognized.

Subspecies and Distribution.

C. o. oculea (Temminck, 1815) - SE Burma and SW Thailand to Peninsular Malaysia.

C. o. ocellata (Raffles, 1822) - Sumatra.

C. o. borneensis Ogilvie-Grant, 1892 - NC and extreme NE Borneo.



Descriptive notes. 23-27 cm; one male 190 g. Very distinctive combination of bright rufous head and underparts, black and white scaling on upper back, mantle, sides of breast and flanks, and bold patterning on rest of upperparts. Male occasionally has two spurs; female has one short 'spur only'. Immature has black markings on nape and chest. Races very similar, differing only slightly in markings, e.g. extent of scaling on lower flanks.

Habitat. Found in evergreen forest, in a variety of situations according to locality, including dry forest in mountains, and both primary and secondary forest in sandy valleys - also in secondary scrub, which is main habitat in Sumatra. Occurs from lowlands up to c. 1000 m.

Food and Feeding. Seeds, grasses, berries, fallen figs and insects reported. Forages in groups of a few birds.

Breeding. No reliable report from Malay Peninsula; in Borneo, locals report domed nest with entrance hole and c. 8-10 eggs in Dec-Jan; 2 downy young collected in Padang Highlands, W Sumatra, but no further details. Incubation 18-20 days (in captivity).

Movements. No information available.

Status and Conservation. Not globally threatened. Mace-Lande: Vulnerable. Widespread in Sumatra, but apparently rare, with fairly few recent records; very scarce in Thailand; no information from Malaysia. Believed declining as consequence of habitat destruction throughout range; overhunted in Thailand. Known from several protected areas in all three countries, including Kaeng Krachan

On following pages: 99. Crimson-headed Partridge (*Haematorix sanguiceps*); 100. Crested Wood-partridge (*Ruficapra ruficapra*); 101. Stone Partridge (*Ptilopus ptilopus*); 102. Mountain Bamboo-partridge (*Bambusiocha fuscata*); 103. Chinese Bamboo-partridge (*Bambusiocha thoracica*); 104. Red Spurtail (*Galloperdix spadicea*); 105. Painted Spurtail (*Galloperdix lunulata*); 106. Ceylon Spurfowl (*Galloperdix bicalcarata*).

National Park in Thailand, Taman Negara National Park in Malaysia and Gunung Leuser National Park on Sumatra. Recent records from 100 m at Sako, W Sumatra, at c. 800 m in W Sumatra, in dry forest in the lowlands of Way Kambas, SE Sumatra, and one at 1000 m at Gunung Leuser National Park. Not protected by Indonesian law. CITES III in Malaysia.

Bibliography. van Balen (1992), Chasen (1939), Davison (1982a), Davison & Scriven (1987), Gibson-Hill (1949), Holmes (1989), Johnsgard (1988), Lekagul & Round (1991), MacKinnon & Philipps (1993), van Marle & Voous (1988), Medway & Wells (1976), Robinson (1915a, 1915b), Robinson & Kloss (1918, 1921, 1924), Round (1988), Smythies (1957, 1981, 1986), Wells (1985).

Genus *HAEMATORTYX* Sharpe, 1879

99. Crimson-headed Partridge

Haematortyx sanguineps

French: Rouloul sanglant **German:** Rotkopfwachtel **Spanish:** Perdicilla Cabecirroja
Other common names: Crimson-headed Wood-partridge

Taxonomy. *Haematortyx sanguineps* Sharpe, 1879 Lawas River, Borneo.

Monotypic.

Distribution. Mountains of N Borneo.



Descriptive notes. c. 25 cm; one male 330 g. Crimson head and blackish plumage very distinctive. Female lacks spurs; plumage generally browner black, with throat, neck and breast rufous orange. Immature duller, with less extensive crimson colouring.

Habitat. Inhabits lower montane forest, including poor quality forest in sandy areas; recorded between roughly 1000 m and 1500 m.

Food and Feeding. Berries and insects, and also small crustaceans recorded in diet.

Breeding. Earliest reported laying mid-Jan.

Nests in *kerangas* forest; nest is made of dry leaves, and situated in a tuft of grass or some

similar situation. Lays 8-9 eggs; incubation 18-19 days (figures presumably from captivity).

Movements. No information available.

Status and Conservation. Not globally threatened. Mace-Lande: Vulnerable. Currently considered near-threatened. Locally common but range much reduced and population therefore assumed to be declining; anecdotal information and restricted range together suggest total of fewer than 10,000 individuals remain. Status unknown in watershed regions of C Kalimantan, where species formerly occurred. Not known from any protected area in Kalimantan, indeed no recent records at all from Kalimantan; reported in Gunung Mulu National Park, Sarawak; occurs in Borneo Mountains Endemic Bird Area. Main causes of assumed population decline are loss and degradation of habitat. Not protected by Indonesian law.

Bibliography. Andrew (1992), van Balen (1992), Davison (1980c), Dutton (1990), Holmes (1989), Johnsgard (1988), MacKinnon & Philipps (1993), Raethel (1988), Smythies (1957, 1981), Wells (1985).

Genus *ROLLULUS* Bonnaterre, 1791

100. Crested Wood-partridge

Rollulus rouloul

French: Rouloul couronné **German:** Straußwachtel **Spanish:** Perdiz Rulul
Other common names: Crested Partridge, Rouloul

Taxonomy. *Phasianus Rouloul* Scopoli, 1786, Malacca.

Often misspelt *rouloul*. Monotypic.

Distribution. S Burma and SW Thailand through Peninsular Malaysia to Sumatra (and some smaller inshore islands) and Borneo.



Descriptive notes. c. 26 cm; male c. 232 g, female c. 202 g. Unmistakable, with spectacular reddish crest, all dark plumage and bright red bare parts. Female very different from male, but equally distinctive, with most of plumage green and head grey. Immature resembles female, but more mottled above; immature male has greyish belly.

Habitat. Evergreen forest, mainly in plains and foothills, but in places up to 1200 m.

Food and Feeding. Seeds, large fruits, large beetles, wood ants, and small molluscs. Association with wild pigs reported, whereby the birds can feed on discarded fragments of fruit

which they would be unable to tackle whole.

Breeding. Laying in most months in Peninsular Malaysia: Dec and Apr in Perak; Feb and Jul in Pahang; Oct in Negri Sembilan; and chicks in Feb-May in Perak, and Sept in Selangor. Nest is simply a depression in dry leaves. Lays 5-6 eggs (occasionally 4); incubation (in captivity) 18-19 days (by Semalokian).

Movements. No information available.

Status and Conservation. Not globally threatened. Mace-Lande: Vulnerable. Formerly widespread but now scarce in Thailand; not uncommon in extreme S Burma in 1940's. Few recent records from Indonesia, although may still be widespread in lowlands, a severely threatened habitat throughout

the whole region; in Sumatra, common at Ketambe (Gunung Leuser) and at Way Kambas; one record at Tanjung Puting, Kalimantan; possibly endangered or extinct on Bangka I and Belitung I (both off SE Sumatra). Presumed to be declining because of logging in several areas, e.g. Peninsular Malaysia; considered vulnerable because of pace of habitat loss and assumed consequent decline in distribution of what was once a widespread species. Reported from several protected areas in three different countries: Khao Pra Bang Khram and Khlong Nakha in Thailand; Taman Negara and Gunung Mulu National Parks in Malaysia; and Gunung Leuser and Tanjung Puting National Parks, and Way Kambas National Park, in Indonesia. Not protected by Indonesian law. CITES III in Malaysia.

Bibliography. van Balen (1992), Chasen (1939), Coomans de Ruiter (1946), Corder (1992), Davison (1979a, 1980c), Davison & Scriven (1987), Farrand & Olson (1973), Gibson-Hill (1949), Holmes (1989), Holmes & Burton (1987), Humphrey & Bain (1990), Johns (1986, 1989), Johnsgard (1988), Lekagul & Round (1991), MacKinnon & Philipps (1993), Madoc (1976), Mann (1987), van Marle & Voous (1988), McGowan (1992b), Medway & Wells (1976), Ogilvie (1949), Robinson (1915a, 1915b), Robinson & Chasen (1936), Robinson & Kloss (1918, 1921, 1924), Round (1988), Smythies (1957, 1981, 1986), Wells (1985).

Genus *PTILOPACHUS* Swainson, 1837

101. Stone Partridge

Ptilopachus petrosus

French: Poulette de roche **German:** Felsenhenne **Spanish:** Gallinita Roquera

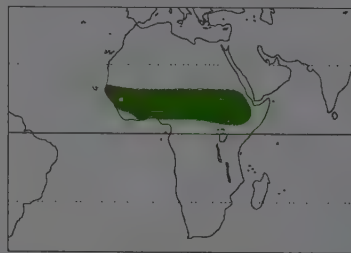
Taxonomy. *Tetrao petrosus* Gmelin, 1789, Gambia.

Proposed races *saturator*, *butleri*, *brehmi*, *emini* and *florentiae* included within nominate *petrosus*. Two subspecies normally recognized.

Subspecies and Distribution.

P. p. petrosus (Gmelin, 1789) - Senegal E to Kenya.

P. p. major Neumann, 1908 - NW Ethiopia.



Descriptive notes. c. 25 cm; male c. 190 g. Presents distinctive aspect due to habit of cocking tail like a bantam fowl; generally appears rather dark. Female has creamy white belly patch. Race *major* is larger and paler, and has broader streaks on flanks.

Habitat. Typically occurs in dense vegetation on boulder strewn rocky hillsides, from 600 m to 1500 m, especially on granite kopjes and laterite outcrops; also lowland savanna, steep dry wooded watercourses, broken woodland with grassland and cultivation nearby, and sandy plains with adequate scrub cover; in Gambia, occurs right down to coastal areas.

Food and Feeding. Grass and herb seeds, green leaves, fruits and buds, and some insects.

Breeding. Season may be influenced by rainfall, with breeding taking place during rains in dry parts of range, and during dry season in wet areas; Dec-Jul in Senegambia; Dec-Mar in Sierra Leone; Nov-Dec in N Mali; Feb-May in S Mali; Jun-Jul in Niger; Jul, Jan, Feb and Apr (young chicks) in Nigeria; all months in Central African Republic; Dec-Jul in Sudan; Aug-Sept in Ethiopia (including Eritrea). Nest is a scrape, well hidden at the base of a rock, tree or tuft of grass and occasionally lined with grass. Lays 4-6 eggs; chicks have blackish chestnut down above, dark brown speckled black below. Young remain with parents for some time, probably until following breeding season.

Movements. Sedentary. Flies only when hard pressed, using a fast, direct style of flight. Climbs cliff faces with some ease.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Little detailed information available, but species considered common, even abundant, in many areas, though rather locally distributed. Subject to some hunting pressure, but there is no indication that this constitutes a major problem.

Bibliography. Ash (1992), Bannerman (1953, 1963), Britton (1980), Brown & Britton (1980), Clarke (1966), Gore (1990), Grimes (1987), Jackson & Selater (1938), Johnsgard (1988), Lewis & Pomeroy (1989), Mackworth-Præd & Grant (1957, 1970), Morel & Morel (1990), Morris (1951), Nikolaus (1987), Raethel (1988), Urban *et al.* (1986).

Genus *BAMBUSICOLA* Gould, 1863

102. Mountain Bamboo-partridge

Bambusicola fytchii

French: Bambusicole de Fytch **Spanish:** Bambuscola Montana
German: Gelbbrauen-Bambushuhn

Taxonomy. *Bambusicola fytchii* Anderson, 1871, Pensee, Yunnan, China.

Two subspecies recognized.

Subspecies and Distribution.

B. f. hopkinsoni Godwin-Austen, 1874 - NE India (Assam and Arunachal Pradesh) S to E Bangladesh and E to N Burma.

B. f. fytchii Anderson, 1871 - SC China (Sichuan and Yunnan) S to EC Burma, NW Thailand and N Vietnam.

Descriptive notes. c. 35 cm; 256-400 g. Distinctive pattern on head and underparts: belly creamy white to pale buff; chestnut outer tail feathers conspicuous in flight. Female usually unspeckled. Immature has wide buffy shaft streaks. Race *hopkinsoni* differs only slightly in details of plumage.

Habitat. Open scrub forest, thickets, and mixed scrub and tall grassland along watercourses at 500-3000 m; also extensively deforested hillsides, where inhabits swaddens with scattered woods above 1000 m.

Food and Feeding. Seeds, berries, shoots and buds, and a variety of invertebrates. Scratches ground.



Breeding. Nesting apparently Mar-Sept (usually Apr-Jul) in China; May-Jul in Burma; Mar-May in India. Nest is a scrape lined with grass and leaves. Usually 4-6 eggs (3-7); incubation 18-19 days, by female only; male stays close to nest.

Movements. Moves out into open to feed in morning and evening, not moving far from water. Flies only when pressed, flying for a few metres before landing in grass.

Status and Conservation. Not globally threatened. Mace-Lande: Vulnerable. Range covers a fairly large area, but distribution believed to be local and fragmented. Considered widespread

and possibly increasing in number in N Thailand; common in Upper Burma; uncommon in China; no recent records from Bangladesh, where may still occur in hill forest in NE & SE of Chittagong Hill Tracts. Formerly found in large numbers in parts of NE India, e.g. up to 27 killed in a single day by 2 hunters; but no recent information. Appears to be undergoing an overall decline. Subject to habitat loss, but is known to affect cultivated areas; hunted in NE Thailand, as well as NE India.

Bibliography. Ali & Ripley (1980), Baker (1935), Cheng Tso-hin (1987), Cheng Tso-hin *et al.* (1978), Deignan (1945), Eichécopar & Hùe (1978), Harvey (1990), He Fen-qi *et al.* (1990), Johnsgard (1988), Lekagul & Round (1991), Meyer de Schauensee (1984), Ripley (1982), Sarker (1986), Smythies (1986), Tang Chun-zhu (1990), Yang Xiaojun *et al.* (1991).

103. Chinese Bamboo-partridge

Bambusicola thoracica

French: Bambusicole de Chine

Spanish: Bambuscola China

German: Graubrauen-Bambushuhn

Other common names: Bamboo Partridge

Taxonomy. *Perdix thoracica* Temminck, 1815, India, error = China.

Two subspecies recognized.

Subspecies and Distribution.

B. t. thoracica (Temminck, 1815) - S China, from Sichuan E to Zhejiang and SE through Guizhou to Guangdong.

B. t. sonorivox Gould, 1863 - Taiwan.

Introduced to Japan and Hawaiian Is.



Descriptive notes. c. 31 cm; 200-342 g. Distinctive head pattern. Female usually unspurred. Immature less colourful; has buffy shaft streaks; dark spots on lower back, rump and uppertail-coverts. Race *sonorivox* generally darker, with much smaller rufous throat patch, and blotches on flanks chestnut, not black.

Habitat. Occurs in bamboo forest, shrubs and grassy areas up to 1000 m, or in places to 2000m.

Food and Feeding. Seeds (including nuts), shoots, leaves and invertebrates.

Breeding. No information available on season. Nest at base of tree, under shrub or in grass

cover. Lays 3-7 eggs; incubation 17-18 days, by female only.

Movements. Short seasonal migrations reported, with birds on tops of hills in summer, but lower down in winter.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Believed to be safe from extinction because of fairly large range and the fact that species is considered common in many areas. Population stable in Taiwan, but declining in China, where becoming uncommon in some areas. Threats in China are loss of habitat to agricultural and urban development, as well as over-hunting; pressures on habitat are also known to be affecting species in Taiwan.

Bibliography. Austin & Kuroda (1953), Brazil (1991), Cheng Tso-hin (1987), Cheng Tso-hin *et al.* (1978), Crowe & Crowe (1985), Eichécopar & Hùe (1978), He Fen-qi & Cui Xie-zhen (1990), Johnsgard (1988), King, B.F. (1989a), Lever (1987), Meyer de Schauensee (1984), Severinghaus & Blackshaw (1976), Tang Ze-sheng & Dai Hong-zhen (1960).

Genus GALLOPERDIX Blyth, 1844

104. Red Spurfowl

Galloperdix spadicea

French: Galloperdrix rouge

German: Rotes Spornhuhn

Spanish: Faisanillo Rojo

Taxonomy. *Tetrao spadiceus* Gmelin, 1789, Madagascar, ex Sonnerat, error = Nepal.

Three subspecies recognized.

Subspecies and Distribution.

G. s. caurina Blanford, 1898 - NW India (Aravalli Hills, S Rajasthan).

G. s. spadicea (Gmelin, 1789) - W Nepal and much of Peninsular India (Uttar Pradesh S to Karnataka and Tamil Nadu).

G. s. stewarti Stuart Baker, 1919 - S India (Kerala).

Descriptive notes. 35.5-38 cm; 284-454 g. Upperparts scaled. Female generally has crown somewhat darker, upperparts barred; differs from other female *Galloperdix* by chestnut underparts with black-tipped feathers. Immature male more richly and deeply coloured than similar adult female. Males of different races separated by extent of black on crown, and by shade of chestnut overall, with *stewarti* richer, darker and virtually unscared, and *caurina* paler and glossier; females of different races differ in colour of upperparts.

Habitat. Occupies a variety of habitat types, especially those in hilly ground that afford cover, e.g. deciduous scrub, often close to cultivation, mostly below 1000 m, but up to 2400 m in places.



Food and Feeding. Seeds, berries, fruits, especially figs, and various invertebrates.

Breeding. Reported in most months: *spadicea* generally in Jan-Jun; *caurina* May-Jun; and *stewarti* in most months except the wettest (Jun-Aug). Monogamous. Nest is a scrape. Sometimes lined with a few pieces of grass and some leaves. Usually 2-5 eggs; incubation by female alone, but both parents tend chicks.

Movements. Sedentary. When alarmed, dodges from one piece of cover to another; runs very fast, flying only when hard pressed, and rarely any distance.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Considered safe because of extensive range, throughout which it is considered widely scattered; also because at any rate in some parts, e.g. S India, species occurs in coffee estates and secondary vegetation. No further information available.

Bibliography. Ali (1979), Ali & Ripley (1980), Baker (1935), Crowe & Crowe (1985), Davison (1986d), Inskipp & Inskipp (1985), Johnsgard (1988), Raethel (1988), Ripley (1982), Sankar *et al.* (1993), Uttigari (1993), Zacharias & Gaston (1993).

105. Painted Spurfowl

Galloperdix lunulata

French: Galloperdix lunulée

German: Perlspornhuhn

Spanish: Faisanillo Moteado

Taxonomy. *Perdix lunulata* Valenciennes, 1826, Bengal.

Monotypic.

Distribution. Peninsular India S of Gangetic Plain, except W & NW. Said to occur in W Bangladesh. Old report from Nepal is erroneous



Descriptive notes. c. 32 cm; male 255-285 g, female 226-255 g. Male unmistakable. Female distinguished from other female *Galloperdix* by combination of rufous or chestnut face, yellowish buff throat and ochraceous brown breast. Immature male duller than adult female and more freckled.

Habitat. Thorn scrub and bamboo in dry areas, e.g. boulder strewn hills; usually below 900 m.

Food and Feeding. Seeds, tubers, drupes (*Zizyphus*, *Lantana*, *Ficus*, etc.) and berries reported; also small land molluscs and insects, especially termites.

Breeding. Nesting Jan-Jun, mainly Feb to early May; also in other months at some localities. Nest is a scrape, lined with leaves and grass, under a rock or a root, or on dry bamboo leaves within a clump. Usually 3-4 eggs (sometimes 5); incubation apparently by female alone, but both parents tend young; downy chicks are pale chestnut-rufous above with darker broad central line, earthy brown and chestnut below.

Movements. Presumably sedentary. More reluctant to fly than *G. spadicea*; when alarmed dodges between pieces of cover; runs very fast, flying only when hard pressed and rarely any distance. Hops from rock to rock on stony hill-sides; if flushed, will fly downwards.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Considered safe because of extensive distribution, and because inhabits secondary vegetation in some areas. Occurs in several protected areas (e.g. Indira Gandhi Wildlife Sanctuary, Amaravathy), but clearly does not rely on these for survival. No further information available.

Bibliography. Ali (1979), Ali & Ripley (1980), Baker (1935), Davison (1986d), Johnsgard (1988), Raethel (1988), Ripley (1982), Sankar *et al.* (1993).

106. Ceylon Spurfowl

Galloperdix bicalcarata

French: Galloperdix de Ceylan

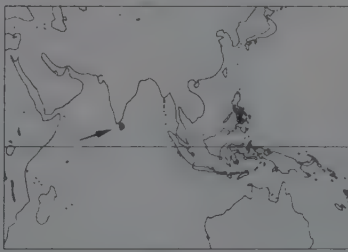
German: Ceylonspornhuhn

Spanish: Faisanillo de Ceilán

Taxonomy. *Perdix bicalcarata* J. R. Forster, 1781, Sri Lanka.

Monotypic.

Distribution. Sri Lanka.



Descriptive notes. 33-35.5 cm; male 312-368 g, female 200-312 g. Male unmistakable. Female differs from other *Galloperdix* by combination of rich chestnut ground colour, grey-brown head and white throat. Immature similar to adults, but immature male has fewer, larger white markings than adult.

Habitat. Forested areas in moist situations up to 1500 m.

Food and Feeding. Seeds and berries, termites and other insects; particularly favours *Striatanthus* seeds during flowering years.

Breeding. Season during NE monsoon in Nov-Mar, but breeding also reported in Jul-Sept.

Monogamous. Nest is a scrape lined with leaves and grass, under rock or bush. Usually 2 eggs, but up to 5; chicks have dark brown down.

Movements. Sedentary. When alarmed, dodges between pieces of cover; runs very fast, flying only when hard pressed and rarely any distance.

Status and Conservation. Not globally threatened. Mace-Lande: Vulnerable. No recent detailed information on status, but must be declining because forests are disappearing. Difficult to observe; recently found in reasonable numbers in remnant forest near Kudawa in Sinharaja Forest Reserve. Restricted range; occurs in Sri Lanka Endemic Bird Area. Further survey work required.

Bibliography. Ali & Ripley (1980), Baker (1935), Garner (1993), Henricsson & Jönvall (1988), Phillips (1975), Raethel (1988).



Subfamily PHASIANINAE

Genus *ITHAGINIS* Wagler, 1832

107. Blood Pheasant

Ithaginis cruentus

French: Ithagine ensanglantée

German: Blutfasan

Spanish: Faisán Ensangrentado

Taxonomy. *Phasianus cruentus* Hardwicke, 1821, Nepal. Considerable intergradation between most of the described races suggests that much of the variation observed is probably clinal, and therefore the validity of many races is dubious; race *affinis* doubtfully distinct from nominate *cruentus*, as is *holoptilus* from *rocki*, and *anna* from *berezowskii*. Fourteen subspecies usually recognized.

Subspecies and Distribution.

- I. c. cruentus* (Hardwicke, 1821) - Nepal.
- I. c. affinis* Beebe, 1912 - NE India (Sikkim).
- I. c. tibetanus* Stuart Baker, 1914 - E Bhutan and SE Tibet.
- I. c. kuseri* Beebe, 1912 - NE India (Upper Assam) and SE Tibet.
- I. c. geoffroyi* J. Verreaux, 1867 - SE Tibet.
- I. c. marionae* Mayr, 1941 - border between Burma and China, in region of Yunnan.
- I. c. rocki* Riley, 1925 - CS China (Mekong Valley, NW Yunnan).
- I. c. holoptilus* Greenway, 1933 - CS China (only known from Lichiang District in Yunnan).
- I. c. clarkei* Rothschild, 1920 - CS China (Lichiang Range, NW Yunnan).
- I. c. michaelis* Bianchi, 1903 - NC China (NW Gansu).
- I. c. beicki* Mayr & Birkhead, 1937 - NC China (N Gansu).
- I. c. berezowskii* Bianchi, 1908 - C China (S Gansu and N Sichuan).
- I. c. annae* Mayr & Birkhead, 1937 - WC China (NW Sichuan).
- I. c. sinensis* David, 1873 - C China (Tsinling Mts, Shaanxi).



Descriptive notes. Male 44-48 cm (tail 16.5-18 cm); female 39.5-42 cm (tail 14-15.5 cm); 410-655 g. Rather small partridge-like pheasant. Female much duller, mainly brown, with forehead, face and throat rufescent cinnamon, sometimes tinged with crimson; some females have small spurs. Immature much duller than adult; at 3 weeks old, male clearly greyer than female. Considerable variation between races in extent of red and black on head of males, and in coloration of underparts; also in greater upperwing-coverts, which are green towards SW and reddish towards NE.

Habitat. In Nepal, inhabits high altitude rhododendron scrub and other types of subalpine scrub at 3200-4400 m; in India, found at 2750-4500 m, e.g. in subalpine scrub. Also occurs in pine and juniper forests, and in bamboo. No recent information from Burma but formerly found above 2500 m.

Food and Feeding. In Nepal, feeds principally on moss, leaf litter and grass shoots; droppings in spring included beetle wing cases; other insects also taken. In autumn, apparently feeds on small fruits, leaves, seeds, moss spore cases, bamboo shoots, berries and rose hips; in winter, diet believed to be primarily fir and juniper shoots, berries, moss and bamboo leaves. After heavy snow, species seen feeding on lily seed cases and associated insects. Feeds by scratching; birds seen feeding at all times of day; will feed arboreally on moss-covered branches.

Breeding. Lays from mid-Apr to late June; most nests found in May. Believed to be monogamous, but polygamy and polyandry reported. Nest is a depression in ground, lined with dead grass stems; 4 nests at 3600 m, and 1 at 4000 m. Lays 2-7 eggs; incubation 26-29 days (in captivity); chicks have dull rufous down on upperparts with dark brown marks, paler rufous below.

Movements. Extent of altitudinal movement due to snowfall varies with geographical location. In summer occurs around tree-line and on alpine meadows above, descending in autumn to open coniferous forests of fir and juniper at lower end of altitude range.

Status and Conservation. Not globally threatened. Mace-Land: *cruentus/affinis/tibetanus/geoffroyi/berezowskii/beicki/michaelis/sinensis/anna* s.a.f.e.; *kuseri/rocki/marionae/holoptilus/clarkei* vulnerable. CITES II. A widely distributed species with a range of over 500,000 km²; the area of available habitat within this, however, is much less, as habitat is naturally fragmented being in upper hills and is likely to have been reduced by a variety of activities. Subspecies cluster of *kuseri*, *rocki*, *marionae*, *holoptilus* and *clarkei* may be vulnerable, as these races have combined range of less than 50,000 km², with possibly as little as 25,000 km² of available habitat; probably declining everywhere except in Bhutan. Race *marionae* from Upper Burma was very common around Chimli Pass, but was snared by the Yawjins in 1940's; no information since then. Species as a whole is known from over 70 locations in Tibet, Sichuan, Yunnan, Qinghai, Gansu and Shaanxi, including Wanlang, Taibaishan, Qilianshan and Feping Natural Reserves; in Nepal from over 20 sites including Langtang, Sagarmatha, Rara Lake and Makalu Borun National Parks, and the Annapurna Conservation Area; in India from at least 3 sites, in addition to Sikkim, where it is the state bird, and is reported to be common and widespread. Considered common in Bhutan in mid-1930's, and there is no reason to consider its status any different at present. Threatened by a variety of habitat pressures, including timber extraction, overgrazing of understorey, and conversion of land to agriculture; also hunted.

Bibliography. Ali (1962), Ali & Ripley (1980), Baker (1935), Cheng Tso-hin (1987), Dayson (1986d), Dong Wei-pi (1990), Hedges & Hu (1978), Gaston (1980a, 1987a, 1987b), Graham (1971, 1976), He Fen-qi (1990), He Fen-qi & Cui Xie-zhen (1990), He Fen-qi & Lu (1991), He Fen-qi et al. (1990), Inskipp & Inskipp (1985, 1986, 1993a, 1993b), Kaul & Ahlud (1993), King & Peng Jiao (1991), Lamba (1980), Ledlie & Yonzon (1986a, 1986b), Li Chun-qiu & Li De-hao (1981), Li Gui-yuan & Zhang Qing-mao (1987), Ludlow & Kincaid (1944), Meyer de Schauensee (1985), Robson (1985), Roles (1990), Shi Deng-cou (1985), Smith (1991), Smythes (1986), Tang Chan-zhi (1990), Tysara (1993), Vaurie (1965d), Yang Lan & Li Zhi-xiang (1984), Yao Jian-chu (1989), Yonzon (1987), Yonzon & Chelici (1980), Zheng Guang-mei & Zhang Zheng-wang (1993), Zheng He-xun & Chen Fuguan (1988).

Genus *TRAGOPAN* Cuvier, 1829

108. Western Tragopan

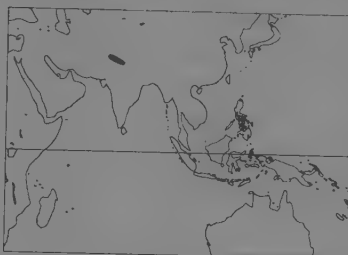
Tragopan melanocephalus

French: Tragopan de Hastings German: Schwarzkopftragopan Spanish: Tragopán Dorsigrís
Other common names: Black-headed/Western Horned Tragopan

Taxonomy. *Phasianus Melanocephalus* J. E. Gray, 1829, Almora, India.

Type locality is outside recorded range of species, but close to its eastern limit; it has been suggested that type specimen was found in a bazaar. Monotypic.

Distribution. NW Himalayas, from N Pakistan to NW India, E to Garhwal, possibly Kumaon and adjacent SW Tibet.



Descriptive notes. Male 68.5-73 cm (tail 22-25 cm), 1800-2150 g; female c. 60 cm (tail 19-20 cm), 1250-1400 g. Male is darkest *Tragopan*; red restricted mainly to neck and upper breast. Female greyish brown with black ocellus-like patches above, and small round white spots below. First-year male similar to adult female in colour, but markings more like those of adult male.

Habitat. Apparently found only in climax, transitional moist or dry temperate forest, typically of brown oak (*Quercus semecarpifolia*) and conifers, with heavy understorey, between c. 2000 m in winter and 3600 m in summer.

Food and Feeding. Few detailed observations, but species believed to be primarily vegetarian, mainly eating new leaves, including those of box, oak and ringal bamboo. Other food items include roots, flowers, and some insects and grubs.

Breeding. Little information. Calling heard at dawn in Mar-Jun. One nest of 6 eggs found in a tree hollow 3 m above ground in late May; another 13 m above ground, possibly an old corvid nest; two other nests on ground; altitude not known. Lays 3-6 eggs; chicks have dark rufous down above, pale buff below, like those of *T. satyra*, but greyer.

Movements. Extent of seasonal altitudinal movements uncertain. In Himachal Pradesh, NW India, believed to be fairly sedentary; elsewhere claimed to breed above 2400 m, up to tree-line, and to winter around 1350 m among oak, chestnut and morena pine.

Status and Conservation. ENDANGERED. Mace-Land: Vulnerable. CITES I. Conservation problems facing present species are better known than for most other species in this family. Total population may number only c. 5000 individuals, and declining. Suitable habitat lost and fragmented by disturbance and removal of understorey through livestock grazing and fodder and firewood collection; also by tree-felling and subsequent agricultural use of land. Collection of non-timber products, e.g. plants for medicinal use, may have a major effect on species during breeding season. Found in several protected areas, including two national parks, the Great Himalayan National Park in NW India, and Machiara National Park in NE Pakistan. Has been subject of several surveys since early 1980's, and was initial focus for the Himalayan Jungle Project in Palas Valley, North-West Frontier Province, Pakistan, where largest population of species occurs; this is a co-operative project involving BirdLife International/WWF/WPA and the Government of Pakistan, amongst others; it seeks to promote local participation in conservation of an extensive tract of mid-altitude temperate forest by developing sustainable use in preference to habitat disruption through logging.

Bibliography. Ali & Ripley (1980), Baker (1935), Chaudhry (1993), Chauhan & Sharma (1991), Cheng Tso-hin (1987), Collar & Andrew (1988), Duke (1989, 1990, 1994), Garson (1989), Gaston (1980a), Gaston, Garson & Hunter (1981, 1983), Gaston, Garson & Pandey (1993), Gaston, Hunter & Garson (1981), Gaston, Islam & Crawford (1983), Islam (1987, 1991), Islam & Crawford (1986, 1987, 1993), Kaul (1989), King (1978/79), Lamba et al. (1987), Mirza et al. (1978), Narang (1993), Pandey (1991, 1993a), Qadri & Kaul (1990), Roberts (1991), Roles (1990), Sharma & Pandey (1989), Sharma et al. (1990), Vaurie (1965d), Zheng Guang-mei & Zhang Zheng-wang (1993).

109. Satyr Tragopan

Tragopan satyra

French: Tragopan satyre

German: Satyrtragopan

Spanish: Tragopán Sátiro

Other common names: Crimson/Indian Tragopan

Taxonomy. *Meleagris satyra* Linnaeus, 1758, Bengal = Sikkim, India.

Has hybridized in captivity with *Lophura swinhoii*. Monotypic.

Distribution. Himalayas in N India from Garhwal E through Nepal, Sikkim and Bhutan to Assam, Arunachal Pradesh and SE Tibet.



Descriptive notes. Male 67-72 cm (tail 25-34.5 cm), 1600-2100 g; female c. 57.5 cm (tail c. 19.8 cm), c. 1000-1200 g. Males in *Tragopan* with deepest red underparts. Others from *T. temminckii*, the only other with bare blue skin on face, in having lower back, rump and upperwing-coverts brown, rather than crimson. Female dull brown to rufous, with bars and lanceolate markings; tail in particular tends to show obvious blueish-ochraceous skin like male *T. temminckii*, which has much more white on the underparts. First-year male similar to adult female in colour, but markings more like those of adult male.

Habitat. In India, occurs in primary forest between 2400 m and 4750 m. Found in Jamnab and rhododendron forests with dense undergrowth and bamboo, at 2590-3800 m in summer, but down to 2100 m in winter, in Nepal and Bhutan. Upper altitude higher in E than in W of range.

Food and Feeding. Droppings in autumn contained mostly small fragments of leaves and quartz, but also grass and root parts, and an insect wing; invertebrates, such as earwigs, ants, spiders and centipedes, also taken. Usually feeds in early morning and middle to late afternoon. When feeding, associated with small streams; forages in damp areas on moss and leaf litter and even on these items in streams. Also feeds in trees and bushes (e.g. *Berberis*, *Symplocos* and *Rhododendron*) taking young leaves, moss and fruit.

Breeding. Calling at dawn in Mar-Jun; display and copulation observed in mid-May; four fledged young seen at end of May in Nepal. Nest in long tussock grass 10 m from forest edge at 3160 m, in early Jun; another made of old twigs and branches in a tree, placed 6 m above ground, and a third nest similar but closer to ground. 2-3 eggs seen in wild, 4-6 in captivity; incubation usually 28 days in captivity; chicks have dark rufous down above, pale buff below.

Movements. Little definite information, but species claimed to winter 1000-2000 m below breeding altitude. At one locality in Nepal, altitude given as 2230-3550 m, with fledged young observed in May at 2640 m. Apparently moves uphill to feed in the early morning, descending after c. 2 hours. **Status and Conservation.** Not globally threatened. Mace-Land: Vulnerable. Occupies restricted and fragmented habitat within a range of less than 100,000 km², suggesting that total population may number less than 20,000 individuals; probably stable in Bhutan, but declining elsewhere. Suitable habitat lost and fragmented by disturbance and removal of understorey, through livestock grazing and fodder and firewood collection; also by tree-felling and subsequent agricultural use of land. Species is hunted for food. Recorded from several national parks in Nepal: Khaftad, Langtang, Sagarmatha and Maluku Barun. Only current conservation initiative is continuation, since early 1980's, of WPA support for guards and a school at Pipar, in Annapurna Conservation Area in C Nepal. Further surveys are needed, as is improvement of the effectiveness of protection of some key areas. Species has potential to be used as flagship species in awareness programmes concerned with threatened climax forests. CITES III in Nepal.

Bibliography. Ali (1962), Ali & Ripley (1980), Baker (1928), Cheng Tso-hin (1987), Clements (1992), Etchécopar & Hue (1978), Gaston (1980a), Inskipp (1989), Inskipp & Inskipp (1985, 1986, 1993a, 1993b), Kaul & Ahmed (1993), Lamba (1980), Leliot & Yonzon (1980a, 1980b), Roles (1990), Tymstra (1993), Vaurie (1965d), Yonzon (1992), Yonzon & Leliot (1980), Zheng Guang-mei & Zhang Zheng-wang (1993), Zwart (1982).

110. Blyth's Tragopan

Tragopan blythii

French: Tragopan de Blyth German: Blythtragopan Spanish: Tragopán de Blyth
Other common names: Grey-bellied Tragopan

Taxonomy. *Cerionis Blythii* Jerdon, 1870, Nagaland, India.

Race *molesworthi* only known from three specimens. Two subspecies recognized.

Subspecies and Distribution.

T. b. blythii (Jerdon, 1870) - now largely confined to Nagaland, NE India. Historically reported from Manipur (NE India), Burma and SC China (NW Yunnan); may still occur in these areas in small numbers.

T. b. molesworthi Stuart Baker, 1914 - E Bhutan (known only from skins of two males and one female).



Descriptive notes. Male 65-70 cm (tail 18-22 cm), c. 1930 g; female c. 58 cm (tail c. 17 cm), 1000-1500 g. Male is only *Tragopan* with red breast and pale smoky grey belly; bare facial skin yellow, as in *T. caboti*, which has no bright red in plumage. Female darker than other *Tragopan* females, with a lanceolate buff marking on each feather of back. First-year male similar to adult female in general colour, but with red on neck. Male of race *molesworthi* differs from nominate in smaller size, with red restricted to upper breast; also in darker upperparts and paler underparts.

Habitat. Densely wooded valleys and hillsides between 1800 m in winter and 3300 m in summer. The three *molesworthi* specimens were taken in forest of thick shrubs and ringal bamboo at 2400-2650 m.

Food and Feeding. Few observations. Diet believed to consist of a variety of seeds, berries, fruits and buds. The single female specimen of race *molesworthi* was collected foraging in rhododendron forest undergrowth; the crop contained fern fronds, leaves of *Spirea*, *Herpospermum caudigerum* (Cucurbitaceae), Ranunculaceae and other leaf, shoot and petiole material; no animal matter; in captivity invertebrates are taken, as, apparently, are frogs.

Breeding. Apparently from early Apr to mid-May. No nests described, but the Nagas say nest is placed in tree, stump or bush, 2-6 m above ground level; made of sticks, lined with twigs and grass. Local people also state clutch is 2-5 eggs (2-6 in captivity); incubation 28-30 days (in captivity); chicks have pale rufous down above, paler below.

Movements. Seasonal movements stated to be small, as weather extremes are not very marked. Recorded at 1500 m in winter, and in moist temperate montane forest at 1800-3000 m in summer. Makes daily foraging trips up hills; locals apparently set snares along well worn trails.

Status and Conservation. RARE. Mace-Land: *blythii* endangered; *molesworthi* insufficient information. CITES I. Little up-to-date information available, due to inaccessibility of NE India and Burma. Species occurs in Eastern Himalayas Endemic Bird Area. Due to restricted range and probably fragmented habitat, total population may number only 500-5000 individuals, and declining. Present in 3 wildlife sanctuaries in Nagaland, NE India. Habitat loss through tree-felling and conversion to agriculture, and hunting for food are main threats known. Status of *molesworthi* unknown, but extensive forest in Bhutan appears to be fairly secure. No specific conservation actions taken in the wild; surveys, education to reduce overexploitation and improved efficiency of protected areas are needed. A studbook for the captive population is maintained by WPA.

Bibliography. Ali & Ripley (1980), Assink & Coles (1989), Baker (1928, 1935), Biswas (1968), Cheng Tso-hin (1987), Collar & Andrew (1988), Etchécopar & Hue (1978), Gaston (1980a), He Fen-qi & Lu Xie-zhen (1990), He Fen-qi *et al.* (1990), Howman (1984), Inskipp & Inskipp (1993b), King (1978/79), Lamba (1980), Meyer de Schauensee (1984), Roles (1990), Smythies (1986), Zeliang (1980, 1987), Zheng Guang-mei & Zhang Zheng-wang (1993).

111. Temminck's Tragopan

Tragopan temminckii

French: Tragopan de Temminck German: Temmincktragopan Spanish: Tragopán Cariazul
Other common names: Crimson-bellied Tragopan

Taxonomy. *Satyra Temminckii* J. E. Gray 1831, Sichuan, China.

Monotypic.

Distribution. E Himalayas from Arunachal Pradesh SE to NE Burma and N Vietnam, and N to C China.



Descriptive notes. Male c. 64 cm (tail 18.5-23 cm), 1362-1447 g; female c. 58 cm (tail c. 17.5 cm), 907-1021 g. Male is *Tragopan* with most red above and below; large pearl grey spots on underparts characteristic. Female rufous to greyish brown, mottled black above and pale brown with black patches and large oval whitish spots below. First-year male similar to adult female in colour, but with some black and red.

Habitat. Inhabits dense evergreen or mixed forest and thick bamboo and rhododendron. Above 2500 m in NE Burma.

Food and Feeding. Diet consists mostly of flowers, leaves, grass stalks, ferns, bamboo sprouts, mosses, berries and seeds of a wide variety of plant species (46 species recorded); some insects also taken. In early winter, seen feeding among branches of rowan and viburnum trees; crops of 2 birds contained 95% (dry weight) of these fruits. In late winter, birds dig in snow with bill, and feed mainly on grass stalks and ferns, including *Rumex*, *Poa annua* and *Dryopteris*.

Breeding. Laying from early May. Nest of dry leaves and branches, lined with feathers; 8 confirmed nests, all in trees 0.5-8 m above the ground. Clutch size 3-5, with eggs laid every other day; incubation 26-28 days, by female alone; chicks have dark rufous down above, pale buff below. Female raises chicks.

Movements. Only information is from Gaoling Mts in Yunnan, SC China, where birds are reported to descend from 2700-3500 m in summer to c. 2000 m in winter.

Status and Conservation. Not globally threatened. Mace-Land: Safe. Widely distributed; successive surveys have reported new localities, and further sites believed to exist in Hubei, Hunan, Guizhou and S Qinghai. However, no recent records from Tibet, Burma or Vietnam; a single female recently seen in Meihao Wildlife Sanctuary in Arunachal Pradesh, NE India; 2 records from Bhutan, both in 1989. Population may number over 100,000 individuals, an estimate based on fieldwork and surveys in some parts of range, and an estimation of extent of habitat available elsewhere. Species declining due to habitat loss and degradation by overgrazing and understorey cutting; also reportedly hunted and eggs collected. Recorded from over 30 protected areas in W Hubei, W Hunan, N Guangxi, Sichuan, Guizhou, S Shaanxi and SE Gansu, in China, as well as Meihao Wildlife Sanctuary in NE India.

Bibliography. Ali & Ripley (1980), Baker (1928), Cheng Tso-hin (1987), Deng Qi-xiang *et al.* (1984), Deng Wei-jie (1990), Etchécopar & Hue (1978), He Fen-qi & Cui Xie-zhen (1990), He Fen-qi *et al.* (1990), King, B.F. (1989b), Lamba (1980), Li Xiang-tao (1986, 1987a, 1987b), Li Xiang-tao & Lu Xiao-yi (1990), Ludlow & Kinnear (1944), Meyer de Schauensee (1984), Rimlinger (1984), Roles (1990), Smythies (1986), Vaurie (1965d), Zheng Guang-mei & Zhang Zheng-wang (1993), Zwart (1982).

112. Cabot's Tragopan

Tragopan caboti

French: Tragopan de Cabot German: Cabotttragopan Spanish: Tragopán Chino
Other common names: Chinese/Yellow-bellied Tragopan

Taxonomy. *Cerionis Caboti* Gould, 1857, China.

Two subspecies recognized.

Subspecies and Distribution.

T. c. caboti (Gould, 1857) - SE China (Guangdong NE to Zhejiang).

T. c. guangxiensis Cheng & Wu, 1979 - SC China (NE Guangxi).



Descriptive notes. Male c. 61 cm (tail c. 21 cm), 1400 g (one bird); female c. 50 cm (tail c. 16 cm), c. 900 g. Male is only *Tragopan* with buff breast, and is palest overall. Female mottled black and rufous brown above, greyish brown below with whitish triangular markings. First-year male similar to adult female in colour, but with some black and red.

Habitat. Evergreen deciduous forest and mixed deciduous-coniferous forest between 800 m and 1400 m.

Food and Feeding. A recent radio-tracking study found that in winter species frequents areas rich in nuts of *Lithocarpus* and *Cyclobalanopsis* and seed capsules of *Schima superba*; after dawn and before dusk birds seen feeding on leaves of the tree *Daphniphyllum macropodum*; 45% of other encounters were of birds feeding in this tree, 48% feeding on the ground and 7% in other trees. Race *guangxiensis* feeds mostly on seeds of *Castanopsis*, *Moghania*, etc.; also takes red beans.

Breeding. Mar-May. Number of birds nesting appears to vary between years; of 15 nests, 11 were at forest edge, mostly in pine *Pinus taiwanensis*, and earliest was found in early Apr. Lays 3-5 eggs (2-6); chicks have dark rufous down above, darker on head, very pale buff below. Female raises brood. Of 15 nests, 13 were lost, 9 to predation, 2 to bad weather (snow fall during egg-laying or continuous rain during incubation) and 2 to other causes.

Movements. In Wuyanling Natural Reserve, Zhejiang, SE China, little vertical movement detected: occurs at 800-1400 m in summer and 800-1000 m in winter. Radio-tracking in Nov-Dec revealed altitudinal movement of less than 300 m.

Status and Conservation. ENDANGERED. Mace-Land: *caboti* vulnerable; *guangxiensis* endangered, CITES I. Species has restricted range and occurs in Fujian Mountains Endemic Bird Area. Fragmented habitat; suggested population of middle thousands, which is thought to be declining. Occurs in at least 4 natural reserves, including Wuyanling Natural Reserve, SE China, where studied by Zheng Guang-mei and team from Beijing Normal University for over 10 years; information collected on densities, habitat, nesting and other aspects is sufficient basis for management where needed. Species threatened by logging and agricultural encroachment, as well as hunting for food, outside protected areas. Very little known about *guangxiensis*.

Bibliography. Cheng Tso-hin (1980, 1987), Cheng Tso-hin & Wu (1979), Collar & Andrew (1988), Ding Chang-qin & Zheng Guang-mei (1993a, 1993b), Etchécopar & Hue (1978), Howe (1986), Howe & Howe (1984), King, B. (1987), King, W.B. (1978/79), LaTouche (1900), Li Huan-hua & Shen Lan-tian (1983, 1985), Meyer de Schauensee

(1984). Roles (1990), Sun Yue-hua & Zheng Guang-mei (1992), Wu Ming-chuan (1988a, 1989), Yan Li (1984), Yang Shi (1987), Young *et al.* (1991), Zhang Jun-ping & Zheng Guang-mei (1990), Zhang Zheng-wang & Zheng Guang-mei (1990), Zhao Xin-ru *et al.* (1990), Zheng Guang-mei (1985, 1986a, 1986b, 1987), Zheng Guang-mei & Zhang Zheng-wang (1993), Zheng Guang-mei, Yin Rong-lun *et al.* (1989a, 1989b), Zheng Guang-mei, Zhang Zheng-wang, Young *et al.* (1990), Zheng Guang-mei, Zhao Xin-ru *et al.* (1985, 1986), Zheng Guang-mei, Zheng Zuo-xin & Wu Ming-chuan (1979).

Genus *PUCRASIA* G. R. Gray, 1841

113. Koklass Pheasant

Pucrasia macrolopha

French: Eulophe koklass

German: Koklasfasan

Spanish: Faisán Koklas

Other common names: Koklass

Taxonomy. *Satyra macrolopha* Lesson, 1829, Almora Hills, Kumaon, India.

Race *bethelae* may be a clinal form of *biddulphi*. Many races regarded as intergrades, raising doubts about validity of subspecific taxonomy; a morph of race *darwini* without chestnut band on underparts was considered a different race, "*stryani*". Ten subspecies usually recognized.

Subspecies and Distribution.

P. m. castanea Gould, 1855 - E Afghanistan E to Pakistan (Chitral).

P. m. biddulphi Marshall, 1879 - Kashmir.

P. m. bethelae R. L. Fleming, 1947 - NW India (Kulu Valley).

P. m. macrolopha (Lesson, 1829) - W. Himalayas, from Kashmir to Kumaon.

P. m. nipalensis Gould, 1855 - W Nepal.

P. m. meyeri Madarász, 1886 - SC China (W & SW Sichuan E to NW Yunnan); extinct in SE Tibet.

P. m. ruficollis David & Oustalet, 1877 - C China (S Gansu, Shaanxi and W Sichuan).

P. m. xanthospila G. R. Gray, 1864 - NE China (Shaanxi NE through W Hebei and SE Inner Mongolia to SW Manchuria).

P. m. joreitiana Heude, 1883 - CE China (Anhui).

P. m. darwini Swinhoe, 1872 - C & E China (Hubei, SE Sichuan, Zhejiang and Fujian); extinct in NW Fujian and N Guangdong.

Descriptive notes. Male 58-64 cm (tail 22-28 cm), 1135-1415 g; female 52-56 cm (tail 17-19.5 cm), 930-1135 g. Medium-sized pheasant with fully-feathered face in both sexes; full crest and lanceolated plumage of male are characteristic. Female brown, marked with black, with pale grey to rufous tinge according to race; crest very short and pale. Immature, including first-year male, similar to adult female. Races vary mainly in extent of chestnut, black and yellowish in plumage



mainly grass, ferns and moss, as well as seeds and fruits of Solanaceae, and seeds and tender needles of pine, spruce and other plants. Gut contents of 29 specimens of *joreitiana* contained mainly young grass and fern leaves and some seeds.

Breeding. Calling at dawn (lasting 5-50 minutes depending on season) Nov-Jun. Little firm evidence, but believed to nest in Apr-Jun, although one nest found in mid-Jul. Incubation 26-27 days in captivity; no information from the wild.

Movements. In Himachal Pradesh (NW India), downward movements of 1000 m have been recorded in winter. It is suggested that, as snowfall is lighter in E than in W, species may not descend so far in E Himalayas.

Status and Conservation. Not globally threatened. Mace-Land: *nipalensis/macrolophacastanea/biddulphi/bethelae* safe; *joreitiana/darwini* vulnerable; *meyeriruficollis/xanthospila* vulnerable. Probably still widespread, but habitat increasingly destroyed and fragmented, resulting in many small populations, often at low densities. Seems to prefer forest with heavy understorey, and this is being degraded by overgrazing and collection of wood for fuel, and by other forms of disturbance (agricultural encroachment, logging, etc.); all of these factors are problems. Hunting is also probably a threat in some areas. No specific conservation initiatives, but species occurs in several protected areas. Two subspecies clusters may warrant conservation attention: *joreitiana* and *darwini*, which have a combined range of less than 50,000 km² in SE China, and for which only anecdotal information exists; and *meyeriruficollis* and *xanthospila*, which comprise central block of races, and which are similarly little known. Baseline surveys to assess status and distribution of birds and habitat are first step.

Bibliography. Ali & Ripley (1980), Baker (1930), Bates & Lowther (1952), Chaudhry (1993), Cheng Tso-hin (1963, 1987), Deng Wei-jie (1990), Etchécopar & Hue (1978), Gaston (1980a), Gaston, Garson & Hunter (1981a, 1981b, 1983), Gaston, Garson & Pandey (1993), Han Demin (1990), Han Demin & Wang Quishan (1993), Harrison & Wayne (1969), He Fen-qi & Cui Xie-zhen (1990), Holzheimer (1990), Howman & Garson (1993), Inskipp & Inskipp (1985, 1986), Khan & Shah (1987), Lamba *et al.* (1987), Leliot & Yunzon (1980a, 1980b), Meyer de Schauensee (1984), Pandey (1993a), Qadir *et al.* (1990), Roberts (1991), Roles (1990), Schäffer (1934), Severinghaus (1979), Shah Iqmail (1993), Sharma & Pandey (1989), Tang Chun-zhu (1990), Vaurie (1965d), Wang Qi-shan (1983), Wang Qi-shan & Hu Xiao-long (1983), Wayne (1964), Yahya (1993), Yunzon & Leliot (1980), Zheng Guang-mei & Zhang Zheng-wang (1993).

of males; race *darwini* has two morphs in parts of range, based on presence or absence of chestnut band on underparts; intermediate birds occur.

Habitat. Coniferous and mixed forests in steep terrain, down to 2000 m in winter, and as high as tree-line at 3000-4000 m in spring. Areas with dense bamboo and understorey.

Food and Feeding. Rarely seen foraging because flushes so quickly, but produces deep feeding scrapes on forest floor. Believed to eat variety of seeds, including acorns, berries and buds; also insects and worms. Droppings in autumn and gut contents of 3 birds contained

inches 12
cm 30

normal morph

115

114

116

dark-throated
dark-rumped morph

ssp murghi

ssp bankiva

117

118

ssp jabouillei

ssp gallus

120

119



Genus *LOPHOPHORUS* Temminck, 1813

114. Himalayan Monal

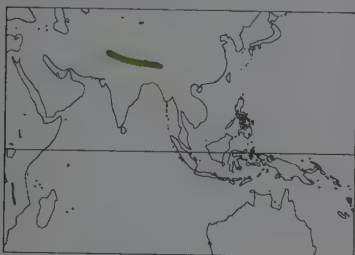
Lophophorus impejanus

French: Lophophore resplendissant **German:** Rostschwanzmonal **Spanish:** Monal Coliriojo
Other common names: Impeyan Monal, Himalayan Monal-pheasant/Pheasant

Taxonomy. *Phasianus impejanus* Latham, 1790, India.

Forms superspecies with *L. sclateri*. Monotypic.

Distribution. E Afghanistan E along Himalayas to Bhutan and NE India, and N into S Tibet; also reported as occurring in Burma.



Descriptive notes. 63-72 cm; 1800-2380 g. Male differs from those of other monals by peculiar wiry crest and entirely rufous tail; chestnut wings and (normally) white rump very conspicuous in flight. Variation among males in several traits; green-breasted, dark-rumped morph frequent in Kashmir. Female differs from those of other monals especially in pattern on underparts and colour of tail barring; also has more or less prominent crest, and generally rather more uniform plumage. Immature similar to female but with markings somewhat less distinct.

Habitat. Inhabits open coniferous or mixed forests with rhododendron and bamboo, usually in steep valleys; also recorded in and around cultivation in some areas. Above tree-line in summer, but down to 2500 m and lower in winter; altitudinal range 2100-4500 m.

Food and Feeding. Diet apparently varies according to locality, but includes seeds, tubers, shoots, berries (e.g. *Cotoneaster microphylla*), insects and their larvae; terrestrial insects and tubers believed to make up most of food taken. Digs extensively with bill, up to depth of 25 cm, creating distinctive dug-over areas on hillsides. In Nepal, 26 droppings contained only vegetable matter. Species forages throughout day.

Breeding. Dawn calling occurs sporadically throughout most of year, but perhaps more predictably in Jan-Jun; display by males observed in Apr. May and once in Sept. at any time of day. In India, egg records from mid-Apr to late June. Breeding can occur at various altitudes, but upper altitudes believed to be far more typical. Nest is a simple scrape under some feature, such as a bush, on a steep hillside; often unlined. Normally 3-5 eggs (2-8), with records of larger clutch size considered suspect; incubation 27 days (in captivity); chicks have chocolate and rufous down above, dirty white below with darker flanks.

Movements. Believed to show greatest altitudinal movement of all Himalayan pheasants. In Himachal Pradesh, NW India, above 3000 m in summer and at 2000-3000 m in winter; in Nepal descends from summer altitude of 4350 m to 3200 m in winter. Possibly performs less movement in E of range. See page 461.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. CITES I. A widely distributed species that is still common throughout its range in suitable habitat. In some areas of Kulu Valley in Himachal Pradesh, NW India, over 70 individuals encountered per 100 hours of fieldwork. National bird of Nepal, where considered a common resident; at Pipar in WC Nepal, a population of 6-9 pairs was estimated in a 1.5 km² study area, giving density of 4-6 pairs/km². Recorded from several sites in Tibet, at edge of range; occurred throughout Bhutan in 1930's, where probably still widespread. Recorded from many protected areas. Tree harvesting and general degradation of habitat are problems in many areas, as is overexploitation for food. In Kulu Valley, male's crest was sought in order to adorn hats, but this practice seems to have become much less common during last 10 years.

Bibliography. Ali (1962), Ali & Ripley (1980), Baker (1928, 1930, 1935), Bales & Lowther (1952), Bisht *et al.* (1990), Catlow (1982), Chaudhry (1993), Cheng Tso-hin (1987), Clements (1992), Etchécopar & Hue (1978), Gaston (1980a), Gaston, Garson & Hunter (1981a, 1981b, 1983), Gaston, Garson & Pandey (1993), Gaston, Lelliott & Ridley (1982), Howman & Garson (1993), Inskipp (1989), Inskipp & Inskipp (1985, 1986, 1993a, 1993b), Kaul & Ahmed (1993), Lamba (1980), Lamba *et al.* (1987), Lelliott & Yonzon (1980a, 1980b), Pandey (1993a), Qadri *et al.* (1990), Roberts (1991), Sathyakumar *et al.* (1993), Sharma & Pandey (1989), Smythies (1986), Tang Chan-zhu (1990), Timsira (1993), Vaurie (1965d), Yahya (1993a), Yin (1970), Yonzon & Lelliott (1980), Zheng Guang-mei & Zhang Zheng-wang (1993).

115. Sclater's Monal

Lophophorus sclateri

French: Lophophore de Sclater **German:** Weißschwanzmonal **Spanish:** Monal Coliblanco
Other common names: Crestless Monal, Sclater's Monal-pheasant/Pheasant

Taxonomy. *Lophophorus sclateri* Jerdon, 1870, Mishmi Hills, north-east India.

Forms superspecies with *L. impejanus*. Proposed race *orientalis*, for eastern populations, not widely accepted. Monotypic.

Distribution. NE India and SE Tibet to NE Burma and SC China (W Yunnan).

Descriptive notes. 63-68 cm; male c. 2500 g, female 2126-2267 g. Male differs from other monals by extensive white from middle back down onto uppertail-coverts, and crest reduced to short, curly feathers. Female crestless, with underparts vermiculated, rather than streaked, and full barring on tail. Immature male resembles adult female, but has darker mantle, whiter rump, and some cinnamon on tail feathers. White on tail of males narrower in E (proposed race *orientalis*) than in W.

Habitat. In China, occurs between 2500 m and 4200 m, in coniferous forest with bamboo understorey, and in subalpine rhododendron scrub. In Burma, believed to remain above tree-line, not descending below 3000 m.

Food and Feeding. Very little known; *Polygonum* seeds and thistle or hard-headed flower heads are only food items specifically mentioned.



Breeding. Birds collected in Tibet in mid-May were in breeding condition; no reliable data on nest, clutch size or incubation; more than one clutch of 5 eggs reported. No further information available.

Movements. No movements described, but species may perform some kind of altitudinal movement according to season.

Status and Conservation. RARE Mace-Lande: Endangered. CITES I. Little up-to-date information available, due to remoteness of range. Occurs in Eastern Himalayas Endemic Bird Area. Due to restricted range and probably fragmented habitat, total population

may number fewer than 10,000 individuals; believed to be stable in China, declining elsewhere. Locally common in Gaoligong Shan Natural Reserve in Yunnan. Possible threats are habitat degradation, and overexploitation of species for food. No specific conservation actions under way in the wild; surveys, education to reduce overexploitation and improved efficiency of protected areas are needed.

Bibliography. Ali & Ripley (1948, 1980), Baker (1928, 1930, 1935), Cheng Tso-hin (1987), Collar & Andrew (1988), Davison (1974, 1978b), Etchécopar & Hue (1978), Gaston (1980a), He Fen-qi & Liu (1991), He Fen-qi *et al.* (1990), King (1978/79), Lamba (1980), Ludlow & Kinnear (1944), Meyer de Schauensee (1984), Roles (1990), Smythies (1986), Tang Chan-zhu (1990), Zheng Guang-mei & Zhang Zheng-wang (1993).

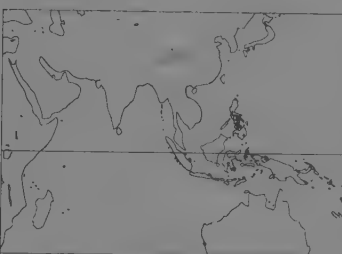
116. Chinese Monal

Lophophorus lhuysii

French: Lophophore de Lhuys **German:** Grünschwanzmonal **Spanish:** Monal Coliverde

Taxonomy. *Lophophorus lhuysii*, Geoffrey St Hilaire and Verreaux, 1866, Moupin, China. Monotypic.

Distribution. C China, in Sichuan, Gansu and Yunnan; no recent records from NW Sichuan, Qinghai or Tibet.



Descriptive notes. 75-80 cm; c. 3008 g. Noticeably larger and more heavily built than other monals, with much stouter bill. Male has droopy crest; no rufous or chestnut in tail feathers, which are mainly glossy blue-green. Female has fairly narrow rufous and black barring on tail and more white on lower back than other female monals.

Habitat. Inhabits subalpine and alpine meadows with bare rock outcrops; mainly occurs at c. 3000-4900 m.

Food and Feeding. Feeds on roots, bulbs, leaves and flowers, including *Anemone rivularis*, *Caltha palustris*, *Primula*, *Allium pratin-*

and *Aconitum tatsienense*, *Fritillaria* bulbs have been stated as major food in one study, minor part in another. Some insects are also taken. In winter, roots of perennial herbs, seeds and occasionally mosses are eaten.

Breeding. Season Mar-June, apparently earlier than other alpine pheasants in Sichuan, China. Nests found at 3800-4000 m, beside crags; at 3900 m, temperature in Apr is 4-7° C, falling to -10° C, with plenty of snow. Single sex flocks seen during breeding period when more than 1 pair in an area. Recorded nests contained 3-5 eggs; incubation 28 days, by female only. Individuals may not breed every year.

Movements. No seasonal movements; despite claims that species moves downhill in winter, evidence shows that it remains at same altitude all year round.

Status and Conservation. ENDANGERED Mace-Lande: Vulnerable. CITES I. Object of study by He Fen-qi of Academia Sinica, Beijing, a study made all the more difficult by remoteness of range; occurs in Eastern Himalayas Endemic Bird Area. Much of species' high altitude range is uninhabitable for humans, and therefore relatively safe. Due to restricted range and probably patchy habitat, total population roughly estimated at 5000-10,000 individuals, although declining slightly. Present in natural reserves in 7 counties in Sichuan. Threats are degradation of habitat and overexploitation of species for food. Captive breeding programme initiated by Endangered Species Breeding Centre in Beijing and San Diego Zoo in USA.

Bibliography. Cheng Tso-hin (1987), Collar & Andrew (1988), Deng Wei-je (1990), Etchécopar & Hue (1978), He Fen-qi & Cui Xie-zhen (1990b), He Fen-qi & Lu Jia-shun (1988), He Fen-qi, Lu Jia-shun & Xie Xian-hua (1989), He Fen-qi, Lu Tai-chun *et al.* (1986), Huang Shi-guang & Lu Fu-jin (1986a), King, B.J. & Peng Ji-jun (1991), King, W.H. (1978/79), Kuehler & Lieberman (1980), Lu Fu-jin, Chou Bing-sung *et al.* (1985), Lu Jia-shun (1985), Lu Tai-chun, He Fen-qi & Lu Rui-sun (1986), Lu Tai-chun, He Fen-qi *et al.* (1986), Lu Tai-chun, Lu Rui-sun *et al.* (1986), Ma Guo-yao (1988), Meyer de Schauensee (1984), Rimlinger & Whitman (1986), Roles (1990), Ruan Xian-dong *et al.* (1993), Schäfer (1934), Shi Dong-chou (1986), Tang Chan-zhu (1990), Vaurie (1965d), Zheng Guang-mei & Zhang Zheng-wang (1993), Zou Zhao-fen (1986).

Genus *GALLUS* Brisson, 1760

117. Red Junglefowl

Gallus gallus

French: Coq bankiva **German:** Bankivahuhn **Spanish:** Gallo Bankiva
Other common names: Wild Junglefowl

Taxonomy. *Phasianus Gallus* Linnaeus, 1758. Poulo Condor, south Vietnam.

Forms superspecies with *G. sonneratii* and *G. lafayetii*; hybridizes locally with *G. sonneratii* in areas of contact. Intergradation occurs between at least three of the accepted races. Five subspecies usually recognized.

Subspecies and Distribution.

G. g. murghi Robinson & Kloss, 1920 - N & NE India, adjacent Nepal and Bangladesh.

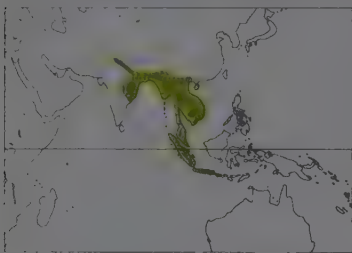
G. g. spadiceus (Bonaterre, 1791) - CS China (SW Yunnan), Burma, Thailand (not E), Peninsular Malaysia and N Sumatra.

G. g. jabouillei Delacour & Kinnear, 1928 - CS China (SE Yunnan, Guangxi and Hainan), N Vietnam.

G. g. gallus (Linnaeus, 1758) - E Thailand through Kampuchea and C & S Laos to C & S Vietnam.

G. g. bankiva Temminck, 1813 - S Sumatra, Java and Bali.

Also occurs in Philippines, Sulawesi and parts of Lesser Sundaes, where probably introduced. Introduced or feral in many areas, including throughout Micronesia, Melanesia and Polynesia; on Reunion and the Grenadines; probably also in New Zealand and South Africa.



Descriptive notes. Male 65-75 cm, 672-1450 g; female 42-46 cm, 485-1050 g. Male differs from that of *G. lafayetii* in form of comb and by absence of heavy streaking in plumage. Female differs from those of *G. sonneratii* and *G. lafayetii* by lack of bold pattern on underparts; and from those of *G. lafayetii* and *G. varius* by lack of bold pattern on flight-feathers. Immature male similar to adult female, but with red on back, and has larger, yellow neck hackles. Variation between races is most noticeable in colour, length and shape of male hackles during breeding season: redder and rounded in *bankiva*; pointed and with dark

markings in *murghi*; race *jabouillei* is somewhat intermediate, with smaller comb and hackles, and no white ear lobe; female *jabouillei* generally rather darker than nominate female.

Habitat. Throughout extensive range, occupies most tropical and subtropical habitats, including mangroves, from sea-level up to c. 2000 m. Seems to prefer flat or gently sloping terrain and edge or secondary habitats to forest.

Food and Feeding. Opportunistic and omnivorous; probably shows seasonal preferences, depending upon availability. Gut contents of 37 birds in India contained seeds of 30 species and many invertebrate taxa; plant genera taken include *Trichosanthes*, *Rubus*, *Carissa*, *Zizyphus* and *Shorea*; only cultivated plant species was rice (*Oryza*). Similarly wide range of food items found in 23 crops from Thailand, including fruits of Euphorbiaceae, bamboo seeds, and *Zizyphus* fruits. Insects recorded include ants, beetles and termites (nearly 1000 in one crop) and their eggs.

Breeding. Mar-May, during dry season, in India, although eggs found Jan-Oct in different parts of the country; Mar-Jun in Bangladesh; Dec-May (peaking Jan-Feb) in Malay Peninsula; Feb-May in China, where earliest records are from S Yunnan. Polygamous. Nests found in many sites, but typically in dense secondary growth or bamboo forest, and situated under bushes or in clumps of bamboo. Usually 5-6 eggs (4-9); incubation 18-20 days, by female only; chicks have maroon-brown down above, whitish buff below, browner on breast.

Movements. No movements described. Presumably none undertaken, as extremes of climate are limited in most of range; nevertheless, in N Thailand, birds apparently descend to lower altitudes in winter.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Species distributed over large range and occurs in variety of habitats, including secondary vegetation and man-made habitats, such as rubber and oil palm plantations. In Thailand, considered widespread and common, with estimated population in hundreds of thousands, despite relentless persecution. In Indonesia, still widespread but declining due to habitat loss and degradation, and also hunting; not particularly common in Java, Sulawesi (where heavily hunted) or Lesser Sundaes, but rather common in Sumatra. In India, considered stable in protected areas, but declining elsewhere due to habitat degradation and overhunting for food. Locally common in Nepal, where reported from several localities, e.g. Sukla Phanta, Bardia, Chitwan and Kosi Tappu, but few records elsewhere, and species believed to have declined in recent years; has apparently been shot out in some areas. Known from protected areas throughout range. Not protected by Indonesian law.

Bibliography. Ali (1962), Ali & Ripley (1980), Baker (1928, 1930), van Balen & Holmes (1993), Bregulla (1992), Bump & Bohl (1961), Chasen (1939), Cheng Tso-hin (1987), Collias (1987), Collias & Collias (1967), Collias *et al.* (1967), Danforth (1958), Deignan (1945), Dickinson *et al.* (1991), Evans *et al.* (1993), Gaston (1980a), Gaston *et al.* (1981a, 1981b), Gibson-Hill (1949), Harvey (1990), He Fen-qi *et al.* (1990), Holmes (1989), Holyoak & Thibault (1984), Inskipp & Inskipp (1985, 1993b), Johnson (1963), Kalsi (1993), Katti *et al.* (1992), Kaul & Ahmed (1993), Lamba (1980), Lekagul & Round (1991), Lever (1987), Marchant & Higgins (1993), van Marle & Voous (1988), Medway & Wells (1976), Montgomerie & Thornhill (1989), Nguyen Cu & Eames (1993), Roberts (1991), Robinson (1915a, 1915b), Robinson & Kloss (1921), Robson *et al.* (1989, 1993a, 1989b), Sarker (1986), Sharma & Pandey (1980), Sri Hawa Yaim (1993), Smythies (1986), Sullivan (1991, 1992), Thornhill (1989), Tymstra (1993), Wells (1990), Zheng Guang-mei & Zhang Zheng-wang (1993), Zuk, Johnson *et al.* (1990a, 1990b), Zuk, Thornhill *et al.* (1990).

118. Grey Junglefowl

Gallus sonneratii

French: Coq de Sonnerat

German: Sonnerathuhn

Spanish: Gallo Gris

Other common names: Sonnerat's Junglefowl

Taxonomy. *Gallus Sonneratii* Temminck, 1813, India.

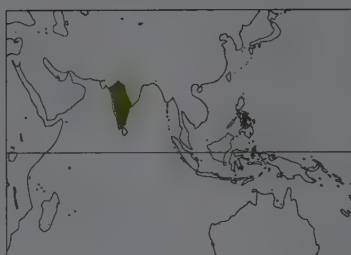
Forms superspecies with *G. gallus* and *G. lafayetii*; hybridizes locally with *G. gallus* in areas of contact. Monotypic.

Distribution. Peninsular India, S from Gujarat, S Rajasthan, Madhya Pradesh and mouth of R Godavari in Andhra Pradesh.

Descriptive notes. Male 70-80 cm, 790-1136 g; female c. 38 cm, 705-790 g. Male generally much greyer than congeners, with rather small comb and hackles, and very distinctive neck pattern. Female differs from those of other *Gallus* by combination of white streaks on breast and unbarred flight-feathers. Immature similar to female; young male soon shows characteristic grey and rusty feathers of adult male.

Habitat. Affects understorey and scrubby parts of evergreen, mixed and deciduous forest, up to 1500 m; also frequents cultivation and abandoned plantations of rubber, coffee and tea, especially where overgrown with *Lantana*; often seen in clearings or along paths.

Food and Feeding. Diverse diet, including seeds of bamboo and *Strobilanthes* among others, shoots of grass and crops, tubers, figs and berries of *Zizyphus*, *Lantana*, *Streblus*, etc. Animals eaten include insects (e.g. grasshoppers and termites) and even small reptiles. Appears to forage



chicks.

Movements. No movements described; some may occur in response to seasonal availability or abundance of local food sources.

Status and Conservation. Not globally threatened. Mace-Lande: Vulnerable. CITES II. Little information on status despite extensive distribution. Believed to be declining, with populations increasingly fragmented, in Kerala at least. Threatened by loss of forested habitats to agriculture, and also by overgrazing and burning of scrub. Hunted for food in some areas; hackles are used in fly-fishing, but demand seems to be satisfied from captive birds. Occurs in more than 10 protected areas in Rajasthan, Madhya Pradesh, Gujarat, Kerala and Tamil Nadu, including Mount Abu and Anamalais Wildlife Sanctuaries, and Vansda, Silent Valley and Eravikulam National Parks. Some studies under way; information required upon which to base management regime.

Bibliography. Ali & Ripley (1980), Baker (1928, 1930), Collias & Collias (1967), Coote (1992), Danforth (1958), Gautam (1992), Johnson (1964), Morejohn (1968a, 1968b), Uttangi (1993), Zacharias & Gaston (1993).

119. Ceylon Junglefowl

Gallus lafayetii

French: Coq de Lafayette

German: Ceylonhuhn

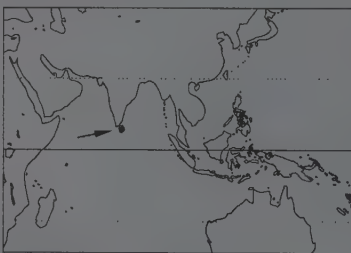
Spanish: Gallo de Ceilán

Other common names: La Fayette's Junglefowl

Taxonomy. *Gallus Lafayetii* Lesson, 1831, India; error = Sri Lanka.

Forms superspecies with *G. gallus* and *G. sonneratii*. Proposed race *xanthimaculatus* not currently accepted. Monotypic.

Distribution. Sri Lanka.



Descriptive notes. Male 66-72 cm, 790-1140 g; female c. 35 cm, 510-625 g. Male has most of plumage boldly streaked; distinctive yellow patch on comb. Female much smaller, with characteristic combination of white markings on underparts and boldly barred wings. Immature male similar to adult female, but with some markings similar to those of adult male.

Habitat. Coastal scrub to mountain forest, from sea-level up to 2000 m.

Food and Feeding. Eight birds shot in Mar had wide variety of food remains in gut, including grass seeds, seed pods, berries and flower petals, scarab beetles, termites, mol-

luses, woodlice and ticks; termites and grass seeds common. Commonly seen foraging along open tracks through forest in mornings and evenings, especially after rain. Foraging tends to be curtailed by midday heat.

Breeding. Eggs apparently found in all months, with Feb-May most usual; in N Sri Lanka, Feb-Aug; in E, at Batticaloa, Feb-Oct. Nests in a variety of locations, typically on ground amongst bushes, under logs, etc.; will use deserted squirrel nests; also recorded in old crow nest, c. 10 m above ground level. Clutch usually 2 eggs (2-4); larger clutches (of up to 9 eggs) reported, but believed to be multiple clutches, laid by more than 1 female; incubation in captivity 20-21 days; downy chicks similar to those of *G. gallus*, with darker markings.

Movements. Believed to be sedentary, although fruiting *Strobilanthes* apparently attracts birds from a long distance to feed.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. No recent information on status. Apparently tolerates human disturbance and habitat degradation well. Species has restricted range and occurs in Sri Lanka Endemic Bird Area.

Bibliography. Ali & Ripley (1980), Baker (1928, 1930), Collias & Collias (1967), Deraniyagala (1957), Henry (1971), Morejohn (1968a), Phillips (1978), da Silva *et al.* (1993).

120. Green Junglefowl

Gallus varius

French: Coq de Java

German: Gabelschwanzhuhn

Spanish: Gallo de Java

Other common names: Javan Junglefowl

Taxonomy. *Phasianus varius* Shaw, 1798, Java.

Formerly included in monospecific genus *Ceagrus*. Monotypic.

Distribution. Java and neighbouring islands of Lesser Sundaes E to Flores, Sumba and Alor.



Descriptive notes. Male c. 70 cm, female c. 40 cm; 454-795 g. Male unmistakable, with appearance of scaling. Different colours over most of dark green plumage; multicoloured comb and hackles distinctive. Female differs from those of other *Gallus* by combination of scaly upperparts, barred wings and lack of bold pattern on breast. Immature resembles female.

Habitat. Coastal areas and low-lying valleys, but also found in inland forest. Inhabits forest margins and scrub around rice plantations and other cultivation, from sea-level up to over 2000 m.

Food and Feeding. Very little known, but believed to feed on insects and weed seeds and to visit grain fields regularly. In captivity consumes seeds, berries, leaves, fruit, insects and worms.

Breeding. Little reliable information available, but season believed to be long and variable in Java; usually Jun-Nov; 16 nest records for period Mar-Nov, with 8 in May-Jun; earlier in E Java than in W. Nest is a depression in ground among dense vegetation; occasionally placed atop a tree-fern. Data on clutch size are unreliable, with claims of average 8 eggs (6-12) probably too high, and 3-4 eggs more likely; incubation in captivity 21 days; chicks have chocolate brown down above, creamy white below, with brown neck and breast.

Movements. No movements described.

Status and Conservation. Not globally threatened, Mace-Lande: Safe. Occurs in a variety of habitats, including secondary vegetation and man-made habitats, e.g. coffee plantations, and therefore not of immediate conservation concern. Widespread throughout range and found near human

settlements in heavily populated areas on Java. Found in many protected areas of various designations, but such areas may not be essential for long-term survival of species. At present, most important conservation requirement is cessation of overexploitation of wild populations, as species is trapped extensively for pet trade; species is hybridized with domestic fowl, and male offspring are much prized for vocal competitions; this activity was once the practice exclusively of inhabitants of Kangean Is (off NE Java), but entire villages along N coast of Bali now pursue this same activity, with result that many males are now being removed from populations; in 1980, the hybrid, known locally as *hekisar*, was declared provincial bird of East Java, resulting in an increase in trade.

Bibliography. van Balen & Holmes (1993), Delacour (1978), Holmes (1989, 1991), Hoogerwerf (1949), Howman (1993), MacKinnon (1988), MacKinnon & Phillpotts (1993), Morejohn (1968a), Stemer (1945), Sumatjda (1981), Wayne (1969), White & Bruce (1986)



Genus *LOPHURA* Fleming, 1822

121. Kalij Pheasant

Lophura leucomelanos

French: Faisan leucomèle

German: Kalifasan

Spanish: Faisán Kálif

Other common names: Kalij

Taxonomy. *Phasianus leucomelanos* Latham, 1790, India.

Forms a superspecies with *L. nychthemera*. Formerly included in genus *Gemnaeus*. Races *oatesi*, *lineata* and *crawfordi*, forms to E of R Irrawaddy in Burma, are more closely related to some races of *L. nychthemera* than to other races of present species to W of Irrawaddy; revision of these two species needed. Several races of dubious validity: *horsfieldii* is a synonym of *lathamii*. Specific status has been proposed for races *lathamii* and *lineata*. Nine subspecies currently recognized.

Subspecies and Distribution.*L. l. hamiltoni* (J. E. Gray, 1829) - W Himalayas, from R Indus E to W Nepal.*L. l. leucomelanos* (Latham, 1790) - W & EC Nepal.*L. l. melanota* (Hutton, 1848) - NE India (Sikkim) and W Bhutan E to R Sankosh.*L. l. moffitti* (Hachisuka, 1938) - described from captive birds; only reliable record in wild from C Bhutan.*L. l. lathamii* (J. E. Gray, 1829) - E Bhutan and NE India (Assam) E to Burma (probably E to R Irrawaddy).*L. l. williamsi* (Oates, 1898) - W Burma, E to R Irrawaddy; possibly also in NE India (E Manipur).*L. l. oatesi* (Ogilvie-Grant, 1898) - Arrakan Yomas in S Burma, E of R Irrawaddy.*L. l. lineata* (Vigors, 1831) - S Burma E of R Irrawaddy S to W Thailand.*L. l. crawfordi* (J. E. Gray, 1829) - SE Burma (Tenasserim) and peninsular Thailand.Introduced (*leucomelanos*) to Hawaiian Is.

Descriptive notes. Male 63-74 cm (tail 21-35 cm), 795-1150 g; female 50-60 cm (tail 19-23.5 cm), 564-1024 g. Male is amongst most variable pheasants; mainly blue, with long crest and scarlet face wattles; legs pale brown, greenish or grey, not crimson as in *L. nychthemera*. Female mostly reddish brown or dark brown with pale markings. Immature dark brown; male assumes adult plumage in 1st year. Considerable variation in male plumage among races, mainly in colour of breast, extent of white markings on lower back, rump and tail; race *hamiltoni* has white crest.

Habitat. Occurs in variety of habitats, from evergreen and deciduous forests with dense undergrowth in valleys to thickets, secondary vegetation and abandoned cultivation; down to altitude of 25 m in NE Bangladesh.

Food and Feeding. Omnivorous. Diet consists of items as diverse as bamboo seeds and small snakes, but especially termites, figs, forest yams and bamboo seeds; other identified items include acorns, ripe *Pyrus* and *Rosa* fruits, *Vicium* stems, *Desmodium* pods, *Dioscorea* bulbils, seeds of *Nyctanthes*, nettle and fern tops and *Polygonum* and *Rubus* fruits. Believed to forage in small groups (possibly family units); usually scratches ground, but can dig for roots and tubers.

Breeding. Considerable variation with race, usually including Apr and May; *hamiltoni* Mar-Jun; *leucomelanos* Apr-Jun; *melanota* Mar-May; *lathamii* Feb-Oct (mostly Apr-May and Jul-Aug); *williamsi* Apr-May (possibly Mar-Jun); *oatesi* Mar-May; *lineata* Feb-Jul. Nest is a slight hollow in thick undergrowth, usually near water. Usually 6-9 eggs (5-10); 14-15 eggs reported, probably laid by more than 1 female; incubation from 20 days in warmer parts, to 22 in cooler, higher areas, by female only; chicks have chestnut and brown down above, whitish below. Male seen leading small chicks.

Movements. Little information. Believed to be sedentary, although some seasonal movement likely in N. Long daily excursions to water sources may occur in some areas.

Status and Conservation. Not globally threatened. Mace-Land: *hamiltoni*, *leucomelanos*, *melanota*, *lathamii*, *williamsi* safe; *moffitti* insufficient information; *oatesi*, *lineata*, *crawfordi* vulnerable. Occurs in variety of habitats, including secondary vegetation, so status not of immediate concern, situation varying with race. Great attention paid to *moffitti* due to paucity of data; known only from birds exported from Calcutta bird market in 1930's (?and 1920's) until seen in Bhutan in early 1993. Very common in NW Indian Himalayas; fairly common in Nepal; rare resident in Bangladesh; no information from Bhutan. Large coveys regularly encountered in autumn at several sites in Himachal Pradesh, NW India; birds may be seen more often in disturbed areas near villages. Threats include loss and degradation of habitat and overexploitation for food.

Bibliography. Ahmed & Musavi (1993), Ali (1962), Ali & Ripley (1980), Baker (1928, 1930, 1935), Bump & Bohl (1961), Choudhury (1993), Cheng Tso-hin (1987), Delacour (1948, 1949), Dinesh & Chandola-Sakam (1993), Ettemeyer & Hsu (1978), Gaston (1980a), Gaston, Garson & Hunter (1981a, 1981b, 1983), Gaston, Garson & Pandey (1993), Harvey (1990), He Fen-qi et al. (1990), Humphreys & Bam (1990), Inskipp & Inskipp (1985, 1993b), Iqbal (1992, 1993), Kail & Ahmed (1993), Lamba (1980), Lekagul & Round (1991), Lever (1987), Lewin & Lewin (1984), McGowan & Panchen (1994), Mukhim & Michael (1993), Pandey (1993a), Qadri et al. (1990), Roberts (1991), Robinson & Kloss (1921), Round (1988), Saklani et al. (1990), Sarker (1986), Sathyakumar & Syam (1992), Sathyakumar et al. (1993), Smythies (1986), Tang Chao-zhu (1990), Yvonne (1965d), Yonzon & Lecliot (1980), Zheng Guang-mei & Zhang Zheng-wang (1993).

122. Silver Pheasant

Lophura nychthemera

French: Faisan argenté

German: Silberfasan

Spanish: Faisán Plateado

Taxonomy. *Phasianus nychthemera* Linnaeus, 1758, China.

Forms superspecies with *L. leucomelanos*. Previously placed in genus *Gemnaeus*. Many races of questionable validity, based on plumage patterns of male upperparts; seven races, *rufipes*, *occidentalis*, *ripponi*, *jonesi*, *beaulieu*, *nychthemera* and *fokiensis*, at least, form cline and probably not subspecifically distinct from one another. Fifteen subspecies currently recognized.

Subspecies and Distribution.*L. n. occidentalis* Delacour, 1948 - SC China (NW Yunnan) and NE Burma.*L. n. rufipes* (Oates, 1898) - N Burma in Northern Shan States, between R Irrawaddy and R Salween.*L. n. ripponi* (Sharpe, 1902) - N Burma in Southern Shan States, between R Irrawaddy and R Salween.*L. n. jonesi* (Oates, 1903) - SC China (SW Yunnan), N & C Thailand and Burma (South Shan

States, between R Salween and R Mekong).

L. n. omeiensis Cheng, et al., 1964 - C China (Sichuan).*L. n. rongjiangensis* Tan & Wu 1981 - SC China (SE Guizhou).*L. n. beaulieu* Delacour, 1948 - SC China (SE Yunnan), N Laos and N Vietnam.*L. n. nychthemera* (Linnaeus, 1758) - S China (Guangdong and Guangxi) and N Vietnam.*L. n. whiteheadi* (Ogilvie-Grant, 1899) - Hainan I (S China).*L. n. fokiensis* Delacour, 1948 - SE China (NW Fujian and possibly Zhejiang).*L. n. berliozii* (Delacour & Jabouille, 1928) - C Vietnam, on W slopes of Annamite Mts.*L. n. beli* (Oustalet, 1898) - C Vietnam, on E slopes of Annamite Mts.*L. n. engelbachi* Delacour, 1948 - Bolovens Plateau, S Laos.*L. n. lewisi* (Delacour & Jabouille, 1928) - SW Kampuchea and SE Thailand.*L. n. annamensis* (Ogilvie-Grant, 1906) - S Vietnam.

Descriptive notes. Length very variable with race. Nominate male 120-125 cm (tail 60-75 cm); female 70-71 cm (tail 24-32 cm). Race *lewisi* male c. 67 cm (tail c. 30 cm); female c. 61 cm (tail 23-25 cm). Weight (overall) male 1130-2000 g, female 1150-1300 g. Male (most races) has strikingly contrasting white and bluish black plumage; long crest, scarlet wattles and crimson legs. Female mostly reddish brown or dark brown with pale markings more or less obvious. Immature is brown, finely vermiculated black above; male assumes adult plumage in 2nd year. Considerable variation in male plumage among races.

mainly in extent of black markings on back, rump and tail; birds whitest and with longer tails towards NE; S race *lewisi* darkest, with shortest tail.

Habitat. Variety of forested habitats, in SE of range, mostly above 1000 m; in NW may occur in more open habitats, including grassland bordered by forest, but conflicting information. In Thailand, occurs in both semi-evergreen and hill-evergreen forests. Reportedly in less open areas than *L. leucomelanos*.

Food and Feeding. In Guangdong (S China), 64 plant items and 30 animal species recorded in 13 gut contents taken throughout year; especially seeds and fruits of *Castanopsis chinensis* and *Fagaceae*. Feeds by scratching and occasionally by digging.

Breeding. In China, laying from mid-Mar in C Guangdong, otherwise from Apr onwards; thought to be Mar-May in Upper Burma and Thailand, but little reliable information. In Guangdong, 10 nests averaged 6-9 eggs, but one contained 12, all 12 hatching; chicks appear in wet season (with high temperature and humidity), latest hatching in early Jun. Incubation in captivity 25-26 days; chicks have chestnut and dark brown down above, whitish below. Has bred at 1 year old in captivity.

Movements. No information available.

Status and Conservation. Not globally threatened. Mace-Land: *annamensis* endangered; *whiteheadi* endangered; *engelbachi* endangered; *lewisi* vulnerable; all other races safe. Widely distributed and seemingly common in suitable habitat, so status not of immediate concern, but several isolated races merit attention. In China, considered common or very common and stable, depending on locality, but some isolated races may be rare and declining; in Thailand, estimated to number tens of thousands, possibly declining. Based on extent of habitat available, *annamensis* in Vietnam estimated to number 500-5000, and likewise *engelbachi* in Laos; *whiteheadi* on Hainan I likely to number less than 10,000, as does *lewisi* on the border between Thailand and Kampuchea. Suffers various forms of habitat loss and degradation and overexploitation for food; particular pressures vary from place to place.

Bibliography. Baker (1928, 1930), Cheng Tso-hin (1963, 1979b, 1987), Cheng Tso-hin et al. (1964), Deignan (1945), Delacour (1948, 1949), Ettemeyer & Hsu (1978), Gao Yu-ren & Liu Zhong-min (1992), Gao Yu-ren & Zhang You-chang (1990), He Fen-qi et al. (1990), Humphreys & Bam (1990), King, B.F. (1989a), Lekagul & Round (1991), Li Bing-hua & Chen Bi-hui (1984), McGowan & Panchen (1994), Meyer de Schauensee (1984), Nguyen Cu & James (1993), Norupuck (1987), Robson et al. (1989, 1993a, 1993b), Round (1988, 1989), Smythies (1986), Tan Yao-kuang & Wu Zhi-kang (1981), Tang Chao-zhu (1990), Wu Ming-chuan (1988b), Zheng Guang-mei & Zhang Zheng-wang (1993).

123. Imperial Pheasant

Lophura imperialis

French: Faisan impérial

German: Kaiserfasan

Spanish: Faisán Imperial

Taxonomy. *Hierophasis imperialis* Delacour and Jabouille, 1924, Donghoi, C Vietnam.

Formerly placed in genus *Hienphapsis*. Taxonomic status of three Vietnamese endemic *Lophura* forms, *L. e. edwardsi*, *L. e. hatinhensis* and present species is uncertain. Monotypic.

Distribution. C Vietnam. Alleged occurrence in Laos is probably erroneous.



Descriptive notes. Male c. 75 cm (tail c. 30 cm); female c. 60 cm (tail c. 19 cm). Male entirely dark blue; rather short, pointed, blackish blue crest; feathers of lower back, rump, upperwing coverts and upper tail coverts have bright metallic blue edges. Separated from *L. edwardsi* by dark crest and bluish tinges to upperwing coverts. Female chestnut brown above, pale greyish chestnut below. First-year male dark brown, with some blue on feathers of back; adult plumage attained in 2nd year.

Habitat. A. occurring in collections of C. found pair, rugged limestone. Only other record from secondary lowland forest at 50-100 m.

Food and Feeding. No information available.

Breeding. No information other than from captivity: clutch size 5-7, incubation 25 days.

Movements. No information available.

Status and Conservation. VULNERABLE. Mace-Land: Endangered. CITES I. Only recent record was of live bird trapped by ruffian collectors 12 km W of Cat Bin in Feb 1990; only other reliable record was of a live pair sent by ruffians to J. Delacour in 1973. Historical suggestion that species occurs in C Laos, probably erroneous, and based on vague description of a bird given to local hunters. Species has restricted range, occurs in Annamese Lowland, Isthmic Bird Area. Population now estimated to number 100-1500 birds, based on available information. Suspected to be declining. Probably threatened by overexploitation for food and habitat destruction, rampant poaching and mismanagement needed. University of Hanoi has plan to conduct research on C. Ru area. Contemporary range of species very poorly known and extensive surveys are highest priority.

Bibliography. Carpenter & Bates (1993), Corbin & Bates (1985), Delacour (1924, 1925), A. F. Bennett & King (1978/79), Nguyen Cu & James (1993), Raethel (1988), Robson et al. (1993a), Roles (1990), Wiltschko (1988).



124. Edwards's Pheasant

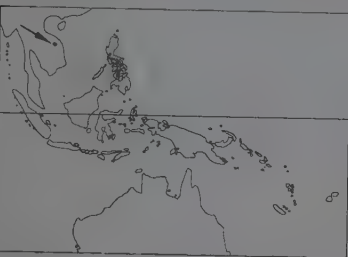
Lophura edwardsi

French: Faisan d'Edwards German: Edwardsfasan Spanish: Faisán de Edwards
Other common names: Annam Pheasant (*edwardsi*); Vo Quy's/Vietnamese Pheasant/Fireback (*hatinhensis*)

Taxonomy. *Gennaues Edwardsi* Oustalet, 1896, Quangtri, central Vietnam. Formerly placed in either genus *Delacourigallus* or genus *Hierophasis*. Taxonomic status of the three Vietnamese endemic *Lophura* forms, *L. e. edwardsi*, *L. e. hatinhensis* and *L. imperialis* is uncertain and requires revision, but very little material available, and biology and ecology of all three forms very poorly known. Status of form *hatinhensis* particularly uncertain: discovered quite recently, and described as separate species, but on insufficient grounds; only ever known from a small area in Vietnam that is now almost completely deforested; limited data available at present suggest that this form is probably best considered a race of present species, although it can not be discounted that future research might indicate that *hatinhensis* does indeed merit treatment as a separate species. Two subspecies currently recognized.

Subspecies and Distribution.

L. e. hatinhensis Vo Quy, 1975 - NC Annam, C Vietnam.
L. e. edwardsi (Oustalet, 1896) - C Annam, C Vietnam.



Descriptive notes. 58-65 cm; tail length in male and female (*edwardsi*) respectively 24-26 cm and 20-22 cm; one male and one female of nominate *edwardsi* respectively 1115 g and 1050 g, one male of race *hatinhensis* 1100 g. Male distinctive in all black plumage with blue gloss and metallic green fringes to upperwing-coverts, contrasting with fairly small white crest; colouring of crest and upperwing-coverts separates from sympatric *L. imperialis*; male of *L. swinhoi* generally more colourful, and has extensive white on upper back and in tail; *L. leucomelanos hamiltoni* also mainly blackish blue with white crest and red facial skin, but has

copious pale markings on underparts. Female generally chestnut brown with no crest; darker flight-feathers and especially tail. Immature mostly chestnut brown, with black markings on upperparts; pale fulvous throat, with rest of underparts chestnut brown vermiculated black; male assumes adult plumage in 1st year. Male of race *hatinhensis* differs from nominate only in having central pairs of rectrices white; female very similar to that of nominate *edwardsi*.

Habitat. Found in level or gently sloping terrain covered by secondary lowland evergreen forest with well developed understorey of palms and rattan, interspersed with patches of bamboo. Allegedly inhabits wet forest up to 600 m. Altitudes of collecting sites and observations during recent surveys suggest that species must occur, if it still survives, in forest on level ground rather than in hill forest. Race *hatinhensis* appears to be confined to forests of level lowlands in NC Annam; can apparently be found in dense vegetation along streams.

Food and Feeding. No information available.

Breeding. All information from captivity: clutch size 4-7; incubation 21-22 days; chicks have dark brown down above, chestnut on crown and sides, buff below.

Movements. No information available.

Status and Conservation. VULNERABLE. Mace-Land: *edwardsi* critical/extinct; *hatinhensis* endangered. CITES I. Only known from its very restricted range in small area of Vietnam. Recent fieldwork in historical range of nominate race failed to find species, and revealed area to be almost completely deforested; it may, however, still exist in small numbers (less than 1000 individuals); last specimen collected in 1928, but species reported to have been seen in 1985. Occurs in Annamese Lowlands Endemic Bird Area. Habitat destruction is clearly main cause for decline, but over-exploitation for food also undoubtedly important. Race *hatinhensis* recently found at Cat Bin; total surviving population now estimated to be within minimum and maximum limits of 100-10,000 individuals, based on available habitat and recent survey work; evidently declining. There are plans to expand recent surveys into Annamese lowland conservation project, led by BirdLife International. Taxonomic clarification required, as *hatinhensis* is known to survive, and may, or may not, be conspecific with *edwardsi*. Further surveys of potentially suitable areas are also urgently needed in S Thua Thien and Quang Tri Provinces, in order to determine presence of any suitable remaining forest patches, and whether they contain present species. A Population and Habitat Viability Assessment should be conducted to simulate the various consequences of different management options on prospects of species' survival, always assuming species remains extant. Large captive population of *edwardsi*, numbering over 500 birds this needs studbook management, especially in case *hatinhensis* really is a distinct species, and *edwardsi* is extinct in the wild.

Bibliography. Collar & Andrew (1988), Delacour (1949), Eames *et al.* (1992), Hachisaka (1941), King (1978/79), Letourneau (1993), Lovel (1977), Nguyen Cu & Eames (1993), Robson *et al.* (1989, 1993a, 1993b), Roles (1990), Rozendaal & Nguyen Cu (1991), Vo Quy (1975), Vuilleumier *et al.* (1992), Wildash (1968).

125. Swinhoe's Pheasant

Lophura swinhoi

French: Faisan de Swinhoe German: Swinhoe-fasan Spanish: Faisán de Swinhoe
Other common names: Formosan Pheasant

Taxonomy. *Euplocamus swinhoi* Gould, 1863, Taiwan.

Has also been placed in genus *Hierophasis*. Monotypic.

Distribution. Endemic to mountains of C Taiwan.

Descriptive notes. Male c. 79 cm (tail 41-50 cm); female c. 50 cm (tail 20-22 cm); (unsexed) c. 1100 g. Male mostly blackish blue, with glossy green feather-tinges on upperwing-coverts, chestnut-maroon patch on scapulars, and snowy white crest, upperback and central tail feathers; bright red wattles and facial skin. Female rather variable, but pale broad lanceolate markings diagnostic. Immature resembles female, but is duller and has upperwing-coverts spotted black and whitish; first-year male resembles adult male, but is duller, partly mottled brown and black, and has dark central rectrices; adult male plumage attained in 2nd year.



Habitat. Inhabits both primary and mature secondary hardwood forest, from 300 m up to 2000 m.

Food and Feeding. Very varied diet, including acorns, berries, flower buds, leaves and other plant materials; also earthworms, millipedes and termites and other insects. Specific items mentioned include berries of *Damianthus indicus* (Rubiaceae), and unspecified parts of *Polygonum chinense* (Polygonaceae), and probably *Neolitsea* (Lauraceae) and *Asplenium* (Polypodiaceae); a variety of other plant species and parts are reported to be consumed. Most feeding seems

to occur in early morning and late afternoon, typically along road edges in herbaceous ground cover; other areas of secondary growth are also used. Feeds by digging.

Breeding. Peak laying probably in Mar-May, unusually Feb, but some reports as late as Oct. Nest data scarce, but indicate that eggs are laid near foot of tree or under rocks, on bare earth or on a few fallen leaves. Clutch 4-8 eggs, local reports of 3-8 (2-12) unconfirmed; incubation in captivity 25 days, by female only; chicks have chocolate brown down above, whitish and rufous below, with orange rufous crown.

Movements. No information available.

Status and Conservation. VULNERABLE. Mace-Land: Safe. CITES I. Due to secretive nature of this, and other *Lophura* species, population estimates are difficult to make with any degree of confidence. Intensive fieldwork in early 1970's suggested that there might be 5000-10,000 individuals; species apparently common in suitable habitat, but declining. Known to have become extinct in several areas, including Kenting since 1960's, and Mits Kuan Tao and Chen Chung where last seen in late 1971; numbers much reduced in some other areas. Recent estimate of c. 6500 individuals in the Yushan National Park (64,229 ha); species also known from several other reserves and protected areas. Habitat is subject to variety of pressures, and species is also trapped for bird trade; in general, probably stable where protected, but declining elsewhere.

Bibliography. Cheng Tso-hun (1987), Collar & Andrew (1988), Delacour (1949), Dijkstra & Hue (1978), Hachisaka & Udagawa (1951), King (1978/79), Meyer de Schauensee (1984), Severinghaus (1977a, 1977b, 1978, 1980, 1986), Severinghaus & Blackshaw (1976), Severinghaus & Severinghaus (1990), Stokes & Williams (1971), Taka Tsukasa & Kano (1939), Tang Chan-zhu (1990), Zheng Guang-mei & Zhang Zheng-wang (1993).

126. Salvadori's Pheasant

Lophura inornata

French: Faisan de Salvadori German: Salvadorifasan Spanish: Faisán Sencillo
Other common names: Hoogerwerf's/Sumatran Pheasant (*hoogerwerfi*)

Taxonomy. *Acomus inornatus* Salvadori, 1879, Mount Singgalang, Padang, West Sumatra.

Has alternatively been placed either in genus *Chalcocornus* or in genus *Houppler*. Race *hoogerwerfi* sometimes considered a distinct species, but very poorly known, and male remains undescribed; might not even merit subspecific status. Two subspecies recognized.

Subspecies and Distribution.

L. i. hoogerwerfi (Chasen, 1939) - Aceh, N Sumatra.

L. i. inornata (Salvadori, 1879) - mountains of S Sumatra, S to Mt Dempo.



Descriptive notes. 46-55 cm; tail c. 16 cm. Male differs from other blackish pheasants by rather unspectacular plumage, pale eye-ring and pale greyish legs; crestless. Female has plumage characteristically covered with pale blotches and paler shaft streaks; pale eye-ring. Immature not described. Female of race *hoogerwerfi* differs from nominate female in having darker grey legs and more uniform, eventually unblotched plumage; male undescribed, although colour photographs (apparently of this form) suggest plumage similar to that of male of nominate *inornata*.

Habitat. Montane forest between 1000 m and 2200 m; recent record in somewhat degraded forest, although with undisturbed forest nearby. Race *hoogerwerfi* collected in forest at 600-2000 m; probable recent sightings on fairly dry forested slopes within same altitude range.

Food and Feeding. No information available.

Breeding. One nest of race *hoogerwerfi* containing 2 eggs found in Feb at 1800 m. No further information available from the wild. In captivity, a clutch of 2 eggs took 22 days to hatch.

Movements. No information available.

Status and Conservation. VULNERABLE. Mace-Land: *inornata* vulnerable; *hoogerwerfi* vulnerable. Nominative *inornata* definitely known from Mt Kerinci in W Sumatra and Mt Kaba in Bengkulu; no recent information from Mt Dempo in S. Until recently, not recorded in wild since period 1913-1917, when 34 specimens collected; rediscovered on Mt Kerinci in 1986, where has subsequently been resighted on a number of occasions; one pair observed on Mt Kaba in Apr 1989. Known to be present in one protected area, Kerinci Seblat National Park (15,000 km²), however, this park suffers heavy human pressure, with constant damage to habitat, which is evident in the very zone where the species has been located. Little recent information available, but total population reckoned perhaps to number less than 20,000 individuals; numbers may be stable at present in montane forest above current logging areas. No confirmed records of *hoogerwerfi* since the two females were collected in 1937 and 1939, although several recent sightings (apparently of this form) from Mantas Valley, in mountains of Aceh, this race appears to be confined to (ranging Leuser National Park (7927 km²)). Species, as a whole, considered vulnerable because of continued large-scale timber extraction, and also species' presumably small population size. Occurs in Sumatra and Peninsular Malaysia (above 800 m) Endemic Bird Area. No specific conservation actions are under way, extensive surveys required to establish limits of distribution, especially in protected areas, so that suitable habitat can be conserved effectively. Race *hoogerwerfi* requires particular attention, especially as might yet prove to be distinct species, and no definite records for over 50

years; possible recent records from Mamas Valley should be pursued. Species not protected by Indonesian law.

Bibliography. van Balen & Holmes (1993), Collar & Andrew (1988), Delacour (1949), Holmes (1989), Houpert & Lasière (1977), Lambert & Howes (1989), MacKinnon & Philipps (1993), van Marle & Voous (1988), Raethel (1988), Robinson & Kloss (1918, 1924), Roles (1990), Wells (1985).

127. Crestless Fireback

Lophura erythrophthalma

French: Faisan à queue rousse **German:** Gabelschwanzfasan **Spanish:** Faisán Colicanelo
Other common names: Rufous-tailed Fireback

Taxonomy. *Phasianus erythrophthalmus* Raffles, 1822, Bengkulu, western Sumatra. Has alternatively been placed in genus *Acomus* or genus *Houppifer*. Two subspecies recognized.

Subspecies and Distribution

L. e. erythrophthalma (Raffles, 1822) - Peninsular Malaysia and Sumatra.
L. e. pyronota (G. R. Gray, 1841) - N Borneo.



Descriptive notes. Male 47-50 cm (tail 15-18 cm), c. 1043 g; female 42-44 cm (tail 14-16 cm), one bird 837 g. Male distinctive, with bright ochraceous yellow central tail feathers; dark bluish black plumage, with greyish upperparts, and dark reddish rump; lacks crest of rather variable *L. ignita*. Female recalls male of *L. inornata*, but differs from all other blackish pheasants by lack of blue fringes on upperparts; has brownish head, greyish throat; also has spurs. Immature black, feathers with rufous chestnut tips; immature male assumes adult plumage at 4 months old. Male *pyronota* differs from nominate male by heavy pale

streaking on neck and underparts; uppertail-coverts steel blue.

Habitat. Found almost from sea-level up to c. 300 m in Malaysia, where may tolerate secondary forest; believed to be a lowland forest specialist in both Sumatra and Kalimantan. If tolerant of wetland forest conditions, range in Sumatra will be much larger, given extensive tracts of forest in E Sumatra, although these are rapidly disappearing.

Food and Feeding. Animal and plant material found in roughly equal proportions in gut contents; animal items included termites, ticks and grubs, plant matter consisted of small hard berries. One pair seen pecking at fallen fruits of *Kuena* (Myristicaceae). No further information available.

Breeding. Eggs found from mid-Mar to Jun. One nest of twigs was located between buttress roots of a dying tree. Clutch of 3-6 eggs; incubation 24 days; chicks have rich dark fulvous down.

Movements. No information available.

Status and Conservation. Not globally threatened. Mace-Lande: *erythrophthalma* vulnerable (Malaysia), endangered (Sumatra); *pyronota* endangered. Sparsely distributed in Peninsular Malaysia, and presumably declining through loss of its lowland habitat. Estimated population, based on extent of available habitat, up to 20,000 individuals. Seems to occur at low densities in Sumatra and Kalimantan. Known to inhabit several protected areas: Krau Wildlife Reserve (530 km²), proposed Endau-Rompin State Park (total area c. 800 km², in states of Johore and Pahang) and in Taman Negara National Park (4343 km²) in Peninsular Malaysia; Gunung Mulu National Park (528 km²) in Sarawak; Way Kambas National Park (1300 km²), Sumatra; no records from existing protected areas in Kalimantan. Threatened by habitat degradation and loss to agriculture and clear-felling for timber production. Extensive surveys are needed in order to determine current distribution of species, and to assess its tolerance of habitat degradation, as well as to ascertain whether or not species occurs in wetland forest. CITES III in Malaysia.

Bibliography. van Balen & Holmes (1993), Banks (1935), Chasen (1939), Coomans de Ruiter (1946), Davison (1979a, 1980c), Davison & Scriven (1987), Delacour (1949), Dutton (1990), Gibson-Hill (1949), Holmes (1989), Holmes & Burton (1987), Jarvis & Medway (1968), MacKinnon & Philipps (1993), Mann (1987), van Marle & Voous (1988), Medway & Wells (1976), Robinson & Chasen (1936), Roles (1990), Siti Hawa Yatim (1993), Smythies (1957, 1981), Wells (1985, 1990).

128. Crested Fireback

Lophura ignita

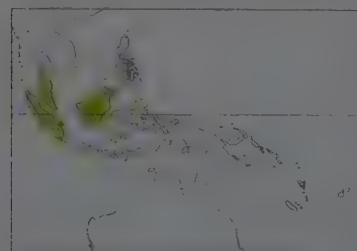
French: Faisan noble **German:** Haubenfasan **Spanish:** Faisán Noble
Other common names: Vieillot's Fireback; Malaysian Fireback (*rufa*)

Taxonomy. *Phasianus ignitus* Shaw, 1797, Java; error = south Borneo (between Pontianak and Bandjarmasin).

Has alternatively been placed in genus *Euplocamus*. Race *rufa* has been considered a distinct species. Race *macartneyi* very variable, and perhaps an unstable form; might be hybrid of *rufa* and *ignita*; *macartneyi* is synonym of *macartneyi*. Four subspecies recognized.

Subspecies and Distribution

L. i. rufa (Raffles, 1822) - Malay Peninsula (S from Isthmus of Kra) and Sumatra (except SE).
L. i. macartneyi (Temminck, 1813) - SE Sumatra, from area of Palembang S to Lampung.
L. i. ignita (Shaw, 1797) - Kalimantan (Borneo) and Bangka I (off SE Sumatra).
L. i. nobilis (P. L. Sclater, 1863) - Sarawak and Sabah (N Borneo).



Descriptive notes. Male 65-70 cm (tail 24-30 cm), 1812-2605 g; female 56-57 cm (tail 15-19 cm), c. 1600 g. Both sexes unmistakable due to combination of characteristically shaped crest and blue facial skin. Immature resembles female, but has large black spots on upperwing-coverts; male darker than female, and assumes dull version of adult plumage at 4 months old. Races vary in size and especially in coloration of tail and underparts in male; race *nobilis* similar to nominate but larger; race *rufa* has crimson legs, and distinctive face wattles in male; males of race *macartneyi* very variable, with several apparently

co-existing colour morphs described, based mainly on amount of rufous on plumage; Bornean birds have yellowish central tail feathers.

Habitat. Probably restricted to plains and foothills in S Thailand, where upper altitude limit is not known. In Malaysia, sparsely distributed from near sea-level up to 1000 m or more, depending on locality. In Indonesia, found in Sumatra and Kalimantan, where regarded as lowland forest specialist; also recorded in logged and secondary forest, but not known from swamp forest.

Food and Feeding. No firm information, other than gut contents of leaves and seeds and some insects; species observed feeding on fallen figs.

Breeding. Little information available on breeding season, with an old record of eggs collected in Apr; also, 4 recently hatched chicks collected in Jul on Borneo. Clutch of 4-8 eggs; incubation 24 days (in captivity); chicks have blackish brown down above, buffy white and rufous below, with rufous crown.

Movements. No information available. Encounters are made unpredictably throughout suitable habitat; it is suggested that birds may be fairly mobile within a defined area, using different parts every few days.

Status and Conservation. VULNERABLE. Mace-Lande: Vulnerable. Population may total over 100,000 individuals but continuously declining; lowland forest habitat severely threatened in many areas. Rare in Thailand, where probably endangered as result of extensive destruction of lowland forests; now extinct on Phuket I. Probably only ever sparsely distributed in S Burma. Uncommon in Peninsular Malaysia; probably common in Sabah, where may actually be commoner in logged than in undisturbed forest. Apparently secure for the present in Indonesia; population of Bangka I, representing link between Sumatran and Bornean populations, is now probably endangered or even extinct, as result of habitat loss; reported to be common in dry, heavily disturbed forests of Way Kambas National Park, S Sumatra. Reported in Ulu Barito and near Malinau, E Kalimantan. Occurs in several protected areas: in Thailand, known from Khao Pra Bang Khrum; in Malaysia, from Taman Negara National Park (4343 km²), Krau Wildlife Reserve (530 km²), Gunung Mulu National Park (528 km²) and Danum Valley Research Centre; in Indonesia, from Way Kambas National Park (1300 km²) in Sumatra, and Tanjung Puting National Park (3050 km²) in Kalimantan. Threatened by habitat destruction for agriculture, and probably extirpated from areas where lowland forest has been lost; has been recorded from logged and secondary forest, but the limits of its tolerance to habitat alteration are not known; statements concerning effects of logging on species must be treated with caution at present because of methodological problems, e.g. small sample size; locally threatened by hunting. Distribution within protected areas should be more clearly established; monitoring of populations is required. CITES III in Malaysia. Not protected by Indonesian law.

Bibliography. van Balen & Holmes (1993), Chasen (1939), Collar & Andrew (1988), Coomans de Ruiter (1946), Davison (1980b, 1981c), Davison & Scriven (1987), Delacour (1949), Dutton (1990), Gibson-Hill (1949), Holmes (1989), Holmes & Burton (1987), Humphrey & Bain (1990), King *et al.* (1975), Lekagul & Round (1991), MacKinnon & Philipps (1993), Mann (1987), van Marle & Voous (1988), Medway & Wells (1976), Riley (1938), Robinson (1913), Robinson & Chasen (1936), Robinson & Kloss (1921, 1924), Roles (1990), Round (1988), Siti Hawa Yatim (1993), Smythies (1957, 1981, 1986), Wells (1985, 1990).

129. Siamese Fireback

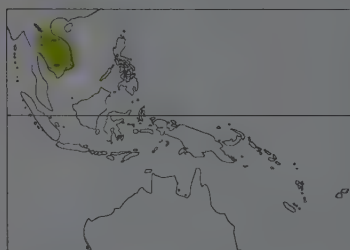
Lophura diardi

French: Faisan prélat **German:** Prälatfasan **Spanish:** Faisán Siamese
Other common names: Diard's Fireback

Taxonomy. *Euplocamus diardi* Bonaparte, 1856, south Vietnam.

Has alternatively been placed in genus *Diardigallus*. Monotypic.

Distribution. E Burma through N, C & E Thailand, C & S Laos and N & C Kampuchea to C Vietnam.



Descriptive notes. Male c. 80 cm (tail 33-36 cm), one bird 1420 g; female c. 60 cm (tail 22-26 cm), 680-1025 g. Male distinctive, with mostly grey upperparts, large wattles and peculiar crest; long dark green tail, characteristic pattern on lower back and rump, and red legs are also distinctive features. Female too quite different from congeners, most notably in having upwringing and central tail feathers black with prominent buffy white barring. Immature similar to female, but duller; young male assumes adult plumage in 1st year, although plumage duller overall and tail shorter.

Habitat. A lowland forest resident. In Thailand, inhabits primary and secondary evergreen forest from plains up to c. 800 m. Also occurs in semi-evergreen and bamboo forest.

Food and Feeding. Believed to be omnivorous, feeding on a variety of fallen fruits and berries, and also insects, worms, small land-crabs, etc. Also claimed to forage by scratching in leaf litter, and searching for insects near cattle. No further information available.

Breeding. Little information other than eggs collected between mid-Apr and late Jun. One nest situated on ground in hollow at base of tree. Clutch seems to consist of 4-8 eggs; incubation 24-25 days (in captivity); downy chicks are mostly brown above, buffy white below.

Movements. No information available.

Status and Conservation. RARE. Mace-Lande: Vulnerable. Based on a recent population estimate for whole of Thailand of c. 5000 individuals, and amount of suitable habitat estimated to remain in other areas, overall population believed to amount to 5000-10,000 birds. Considered scarce in Southern Shan States, in E Burma, in late 1940's. Recently recorded, in Vietnam, at Buon Luo in C Annam; Son Tung in N Annam; and Kon Cha Rang, Gia Lai and Nam Bai Cat Tien National Park, Cochinchina; also, in Laos, at proposed protected area of Xe Pian; no recent information from Kampuchea. Nam Bai Cat Tien National Park (350 km²) in Vietnam, and Xe Pian proposed protected area in Laos are only known protected areas in which species occurs. Threatened by habitat degradation, and overexploitation for food and sport. As species is lowland forest specialist, it is very vulnerable to widespread habitat alterations; protection is a priority.

Bibliography. Anderson (1993), Baker (1928), Collar & Andrew (1988), Delignat (1945), Delacour (1949), Harrison (1968), Humphrey & Bain (1990), Lekagul & Round (1991), Nguyen Cu & Eames (1993), Riley (1938), Robson *et al.* (1989, 1993a, 1993b), Roles (1990), Round (1988), Smythies (1986).

130. Bulwer's Pheasant

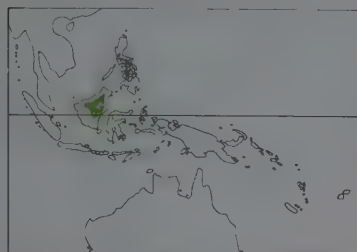
Lophura bulweri

French: Faisan de Bulwer **German:** Bulwerfasan **Spanish:** Faisán Coliblanco
Other common names: (White-tailed) Wattled Pheasant

Taxonomy. *Lobiophasis Bulweri* Sharpe, 1874, Lawas Mountains, Sarawak.

Formerly placed in genus *Lobiophasis*. Monotypic.

Distribution. Inland Borneo. Recent record from Ulu Barito at 150-250 m extends previously known range S from main spinal ranges.



Descriptive notes. Male 77-80 cm (tail 45-46 cm), 1470-1800 g; female c. 55 cm (tail 17.5-19 cm), two birds 916 and 1004 g. Inconspicuous crimson eye-ring and blue facial skin distinctive. Male unmistakable, with voluminous white tail; plumage mostly bluish black with blue feather fringes, and glossy purple throat and breast; blue wattles can be distended to spectacular effect; red legs. Female is only crestless pheasant with blue facial skin. Immature similar to female, but has black marks and buff tips on upperwing-coverts; first-year male resembles adult male, but tail straight and dark chestnut instead of white.

Habitat. Recorded in sub-montane forest up to 1500 m in Kalimantan; in Sarawak and Sabah, mostly inhabits hill slopes in primary hill forest and montane forest between 300 m and 1500 m.

Food and Feeding. Omnivorous; judging by gut contents, ants and termites would seem to predominate; other food items recorded include small crickets, other Orthoptera, small seeds, etc. Scratches on forest floor for food.

Breeding. Indirect evidence suggests long season; immatures collected in Aug. implying egg-laying in Apr; courtship seen in Jul. Single nest known; discovered in Brunei in 1985, among buttress roots of tree in Nov; 1 egg clutch, female was flushed. Broods of 2 seen; clutch size elsewhere claimed to be 5 eggs. Incubation 24-25 days (in captivity).

Movements. No information available.

Status and Conservation. VULNERABLE. Mace-Landé: Vulnerable. Little reliable information, but based on anecdotal information and estimated range area, population may be in the order of 1000-10,000 individuals; possibly stable, but more likely to be declining due to loss and degradation of habitat; reported to be locally common in Malaysian Borneo (Sabah and Sarawak); in past, said to be very common in undisturbed areas of inland Borneo. Recorded from two protected areas: Bukit Raya Nature Reserve (up to 8000 km²) in Kalimantan; and Gunung Mulu National Park (528 km²) in Sarawak. Threatened by overexploitation for food, and loss and degradation of habitat. No specific conservation action undertaken to date; survey required in order to establish true status of species. Protected by Indonesian law.

Bibliography. van Balen & Holmes (1993), Banks (1935), Collar & Andrew (1988), Davison (1980c), Delacour (1949), Dutton (1990), Heinroth (1938), Holmes (1989), King (1978/79), Lambert (1993), MacKinnon & Philipps (1993), Mann (1987, 1989), Roles (1990), Schneider (1938), Smythies (1957, 1981), Wells (1985).



Genus *CROSSOPTILON* Hodgson, 1838

131. White Eared-pheasant

Crossoptilon crossoptilon

French: Hokki blanc **German:** Schmalschwan-/Ohrfasan **Spanish:** Faisán Orejudo Blanco
Other common names: Tibetan Eared-pheasant; Elwes's Eared-pheasant (*harmani*)

Taxonomy. *Phasianus crossoptilon* Hodgson, 1838, probably west China. Race *harmani* sometimes considered a distinct species. Intergrades among races reported, suggesting that several may be of dubious validity. Five subspecies currently recognized.
Subspecies and Distribution.
C. c. harmani Elwes, 1881 - SW & SC Tibet and extreme N Arunachal Pradesh (NE India).
C. c. drouyni J. Verreaux, 1868 - probably E Tibet.
C. c. dolani Meyer de Schauensee, 1938 - WC China (S Qinghai).
C. c. crossoptilon (Hodgson, 1838) - WC China (W Sichuan), SE Tibet and extreme NE India.
C. c. lichiangense Delacour, 1945 - SC China (NW Yunnan).



Descriptive notes. 86-96 cm; male 2350-2750 g, female 1400-2050 g; tail 46-58 cm. Unmistakable. Ear tufts shorter than those of other eared-pheasants. Female resembles male, but slightly smaller, darker and browner; lacks spurs. Immature greyer with buff, chestnut and dark brown markings above and below; acquires adult plumage after two months. Plumage pattern varies considerably between white and slaty grey races, but relation to geographical distribution is not clear.
Habitat. Subalpine coniferous forest between 3500 m and 3900 m, but down to 2800 m in winter.

Food and Feeding. Believed to feed on lily bulbs and stems and bulbs of wild onions; one crop in Dec was full of juniper berries; seen feeding on rowan/mountain ash (*Sorbus*). Feeds by pecking at leaves and digging.

Breeding. Little information from the wild. Eggs probably laid in May-Jun; two nests in late May, one in NE Assam (record questioned) at 3300-3600 m; one nest sited on ground in deep forest. Two clutches of 4 and 9 eggs; incubation (in captivity) 24 days, by female alone; chicks have chestnut brown and rufous down above, creamy yellow below.

Movements. In summer occurs in alpine meadows up to 4600 m, whereas in winter moves down to subalpine spruce and pine forest, possibly as low as 2800 m. Some birds, however, have been seen as high as 4500 m in winter.

Status and Conservation. VULNERABLE. Mace-Land: *harmani* endangered; *crossoptilon/dolani/drouyni/lichiangense* vulnerable. CITES I. Extensive range, but fragmented distribution and apparently specialized habitat requirements suggest that overall total may number as few as 20,000 birds; currently declining. Not known from any protected areas. Threatened by deforestation and hunting for food. Assessment of species' status in protected areas should be determined as soon as possible.

Bibliography. Ali & Ripley (1980), Allen, G.A. Jr. (1994), Cheng Tso-hin (1963, 1987), Collar & Andrew (1988), Delacour (1945), Deng Wei-jie (1990), Elchécopar & Hue (1978), Felix (1964), Gray (1958), Grunnt (1980), He Fen-qí & Cui Xie-zhen (1990), Jiang Zhi-hua (1979), King, B.F. & Peng Ji-tai (1991), King, W.B. (1978/79), Lamba (1980), Liu Ru-sun (1986a, 1986b), Liu Ru-sun *et al.* (1985), Lu Tai-chun (1986), Lu Tai-chun *et al.* (1989, 1990), Ludlow (1951), Ludlow & Kinnear (1944), Mallinson (1979), Robson (1986), Roles (1990), Schafer (1934), Tang Chan-zhu (1990), Vaurie (1965d, 1972), Zhang Zheng-wang (1989), Zheng Guang-mei & Zhang Zheng-wang (1993).

132. Brown Eared-pheasant

Crossoptilon mantchuricum

French: Hokki brun **German:** Brauner Ohrfasan **Spanish:** Faisán Orejudo Pardo
Other common names: Manchurian Eared-pheasant

Taxonomy. *Crossoptilon mantchuricum* Swinhoe, 1863, vicinity of Peking (Beijing); mountains beyond San-yu, Jilin. Monotypic.

Distribution. NE China. Now restricted to five widely separated areas, of which four are reserves; three in Shanxi and one in Hebei; one population recently found close to Beijing.



Descriptive notes. 96-100 cm; male 1650-2475 g, female 1450-2025 g; tail c. 54-5 cm. Unmistakable, as is only brownish *Crossoptilon*. Female usually slightly smaller, and lacks spurs. Immature mottled brown with buff feather tips and short tail; assumes adult plumage after 2 months.
Habitat. Montane broad-leaved and mixed coniferous forests between 1300 m and 2500 m.
Food and Feeding. Mostly plant matter; total of 62 plant, fungus and animal species recorded in diet; main food items include large-flower onion (*Allium macranthum*), sea-buckthorn (*Hippophae rhamnoides*), hawthorn (*Cacalia hastata*), oriental strawberry (*Fragaria orientalis*) and bird vetch (*Vicia cracca*). Seen in small groups digging around grass clumps and feeding on roots.

Breeding. Territories defended Apr-Jun. In Shanxi, 7 nests 210-360 m apart at 1800-2150 m, in larch (*Larix*) and spruce (*Picea*) forest. Nest is a shallow depression in ground. Clutch reportedly 4-14 eggs, and even 22 claimed; incubation (in captivity) 26-27 days, by female alone; downy chicks are mostly rufous and buff above, creamy white below.

Movements. Believed to undertake limited seasonal movements.

Status and Conservation. ENDANGERED. Mace-Land: Endangered. CITES I. Total population probably numbers 1000-5000 individuals, most occurring within protected areas in Shanxi and Hebei; perhaps stable. Occurs in Shanxi Mountains Endemic Bird Area. Small size of populations and their complete isolation from each other are major concerns. Populations outside protected areas probably prone to loss of habitat due to agricultural development and habitat degradation; some egg-collecting takes place. Survival of species is likely to depend upon continued protection of existing populations, and accumulation of sufficient information to permit successful management of small populations. A captive breeding programme is under way at the Pangquangou National Nature Reserve of the Brown Eared-pheasant.

Bibliography. Allen, G.A. Jr. (1994), Cheng Tso-hin (1963, 1987), Collar & Andrew (1988), Delacour (1945), Elchécopar & Hue (1978), Felix (1964), He Fen-qí & Lu Tai-chun (1991), Huang Shi-qiang & Li Fudai (1986b), King (1978/79), Lai Rong-xing (1986), Li Cheng-jie *et al.* (1984), Li Fu-lai & Huang Shi-qiang (1985a), Li Xiang-tao (1993), Liu Huan-jin & Lu Xin (1988), Liu Huan-jin & Su Hua-long (1987), Liu Huan-jin, Su Hua-long & Shen Shou-yi (1991), Liu Huan-jin, Su Hua-long *et al.* (1987), Liu Ru-sun (1986a, 1986b, 1986c), Liu Ru-sun *et al.* (1985), Lu Tai-chun & Lu Ru-sun (1983), Lu Tai-chun *et al.* (1990), Meyer de Schauensee (1984), Rank (1990), Ren Jian-qiang & Hu Yue (1990), Roles (1990), Su Hua-long *et al.* (1986), Tang Chan-zhu (1990), Thompson (1976), Vaurie (1965d), Wang Fu-lin *et al.* (1985), Wise & Fuller (1978), Zhang Jun *et al.* (1983), Zhang Xiu-xiang (1983), Zheng Guang-mei & Zhang Zheng-wang (1993).

133. Blue Eared-pheasant

Crossoptilon auritum

French: Hokki bleu **German:** Blauer Ohrfasan **Spanish:** Faisán Orejudo Azul
Other common names: Pallas's/Mongolian Eared-pheasant

Taxonomy. *Phasianus auritus* Pallas, 1811, interior of China; Sigu, Gansu. Monotypic.

Distribution. C & NC China from E Qinghai E through Gansu to Inner Mongolia, and S to W Sichuan.



Descriptive notes. c. 96 cm; male 1700-2110 g, female 1450-1880 g; tail 49-56 cm. Distinctive combination of grey rump and white base of several outer pairs of rectrices separates from congeners. Female usually slightly smaller and lacks spurs. Immature mottled dark grey-brown with buff feather tips and short tail; assumes adult plumage after 2 months.

Habitat. Coniferous and mixed forests, and among junipers and in scrub on alpine meadows above tree-line.

Food and Feeding. Predominantly vegetarian; takes buds and leaves of barberries, stems and roots of young grasses, and various

herb species; 9 stomachs contained 80% vegetable matter (spruce and *Polygonum* seeds, and leaves of various trees, sedges and herbs) and 20% beetles. Forages in small or large groups, digging during warmer months and feeding on leaf buds and similar during late autumn and winter.

Breeding. Season Apr-June. Nest is a slight depression, under cover of tree or scrub. Clutch averages 8 eggs (6-12); incubation (in captivity) 24-28 days, by female only; downy chicks like those of *C. mantchuricum*, but darker and greyer.

Movements. No information available.

Status and Conservation. Not globally threatened. Mace-Land: Safe. Common throughout range, with no cause for concern. Little information on which to base population estimates, but surveys in Gansu, Sichuan and Qinghai suggest there may be hundreds of thousands of individuals; believed to be stable. Apparently occurs in many giant panda reserves, and so is well protected.

Bibliography. Allen, G.A. Jr. (1994), Cheng Tso-hin (1963, 1987), Delacour (1945), Elchécopar & Hue (1978), Felix (1964), Gray (1958), Li Chun-qu & Li De-huo (1981), Li Gui-yuan (1986), Liao Yan-fa (1984, 1985a, 1985b), Liao Yan-fa *et al.* (1984), Liu Ru-sun (1986a, 1986b), Liu Ru-sun *et al.* (1985), Lu Tai-chun *et al.* (1990), Meyer de Schauensee (1984), Tang Chan-zhu (1990), Thompson (1976), Vaurie (1965d), Zhang Yin-sun (1959), Zheng Guang-mei & Zhang Zheng-wang (1993), Zheng Sheng-wu & Liao Yan-fa (1983).

Genus *CATREUS* Cabanis, 1851

134. Cheer Pheasant

Catreus wallichii

French: Faisan de Wallich **German:** Schopffasan **Spanish:** Faisán Chir
Other common names: Chir/Wallich's Pheasant

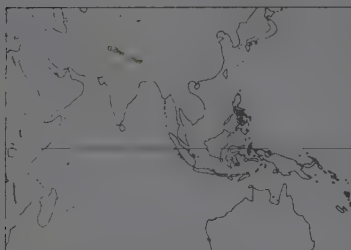
Taxonomy. *Lophophorus (Phasianus) Wallichii* Hardwicke, 1827, Almora, India. Monotypic.

Distribution. Himalayas from extreme E Afghanistan and NE Pakistan to WC Nepal.

Descriptive notes. Male 90-112 cm (tail 45-58 cm), 1250-1800 g; female 61-76 cm (tail 32-47 cm), 900-1360 g. Not brightly coloured but nevertheless unmistakable. Very variable black markings on upperwing-coverts and on underparts, especially in male. Female considerably smaller. Immature like female but duller, less boldly marked and lacks crest.

Habitat. Occurs on steep grassy and craggy hillsides covered with scrub, stunted trees, and in secondary vegetation, from 1200 m up to 3050 m; in some areas, also found in burnt, felled and cut-over areas of mixed pine, juniper, fir and rhododendron forest with secondary growth.

Food and Feeding. Feeds on items such as roots, tubers, bulbs; buried seeds and possibly insect larvae and earthworms. A recent study found that all material in droppings was from plants; in Mar, mainly *Poa annua*, *Rosa moschata* and *Berberis* leaves; in Apr, *Rumex* roots, *Gnaphyllum*



hypoleuca leaves and *Arisaema jacquemonti* bulbs; in May, *Rumex* bulbs and buckwheat (*Phagopyrum tataricum*); and in Jun, *Frage-ria indica* leaves, buckwheat and *Poa annua*; no insect items found, but increased nitrogen excretion in Jun may come from this food source. Forages by digging.

Breeding. Breeds in late Apr-Jun, depending upon altitude. Monogamous. Calling at dawn and dusk throughout year, except in Jul-Sept, immediately after breeding period. Nest usually located in grass, at base of rocky crag. Usually 9-10 eggs (9-14); incubation (in captivity) 26 days, by female, although male stays

close by; chicks have grizzled chocolate brown down above, creamy white and greyish below.

Movements. During surveys and studies since 1980 species recorded from 1500 m up to 3140 m in India and Nepal, but detailed assessment of seasonal movements lacking; probably some altitudinal migration. At Dhorpatan, in Nepal, a site considered exceptionally high at over 2800 m, birds were recorded in late May and early Jun. Elsewhere reported from as low as 1200 m in cold weather, and up to 3000 m in summer.

Status and Conservation. ENDANGERED. Mace-Lande: Vulnerable. CITES I. Probably always occurred in very small, isolated populations; estimated density of 5-10 breeding females/km². Whilst species seems able to survive in such small numbers, each population is susceptible to a variety of pressures, which stem from requirement for a habitat that is heavily altered by man; its vocal nature makes it ready prey for hunters, and agricultural encroachment of hill grassland is also a threat. Repeat visits have been made to a number of sites surveyed several years previously and numbers appear to be stable. Occurs in at least 9 protected areas, including the Great Himalayan National Park in India and Lake Rara National Park in Nepal; population in Chail Wildlife Sanctuary, India, is probably the largest so far located; may be almost extinct in Pakistan. Future of species is likely to depend on effective ban of hunting, and appropriate management of grassland. **Bibliography.** Ali & Ripley (1980), Baker (1928, 1930), Beer & Cox (1980), Burt & Young (1988), Chaudhry (1993), Collar & Andrew (1988), Garson (1983), Garson *et al.* (1992), Gaston (1980a), Gaston & Singh (1980), Gaston, Garson & Hunter (1981a, 1981b, 1983), Gaston, Garson & Pandey (1993), Grahame (1988), Hussain (1990), Hussain *et al.* (1986), Inskipp (1991), Inskipp & Inskipp (1985, 1986), Kaul (1989, 1990a, 1990b, 1990c, 1993), King (1978/79), Lelliott (1981, 1987), Lelliott & Yonzon (1980a), Mirza (1980), Pandey (1993a), Qadri *et al.* (1990), Ridley & Islam (1987), Roberts (1991), Sathyakumar *et al.* (1992), Severinghaus *et al.* (1979), Sharma & Pandey (1989), Sharma *et al.* (1990), Young *et al.* (1987).

Genus SYRMATICUS Wagler, 1832

135. Elliot's Pheasant

Syrmaticus ellioti

French: Faisan d'Elliot German: Elliotfasan Spanish: Faisán de Elliot
Other common names: White-necked/Long-tailed Pheasant, (Chinese) Bar-backed Pheasant

Taxonomy. *Phasianus ellioti* Swinhoe, 1872, mountains near Ningpo, Zhejiang, China.

Has been placed in genus *Calophasis*. Monotypic.

Distribution. SE China from Jiangsu and Anhui S through Zhejiang, Fujian and Hunan to Guizhou and Guangxi.



Descriptive notes. Male c. 80 cm (tail 39-44 cm), 1044-1317 g; female c. 50 cm (tail 17-19.5 cm), 726-1090 g. Whitish grey (male) or fulvous grey (female) hood diagnostic. Female also differs from those of other *Syrmaticus* in black throat. Immature duller than female, with white throat; males show barred tail from early stage.

Habitat. Evergreen broad-leaved forest (*Lithocarpus*, *Cyclobalanopsis*, etc.) mixed evergreen broad-leaved and coniferous forest, and pure coniferous forest between 300 m and 1500 m.

Food and Feeding. Reported to feed on seed pods, seeds, berries and leaves of various

species; a few ants constitute the only animal material known.

Breeding. In W Zhejiang, laying from mid-Mar to late May. Display performed in early morning and early afternoon. Nest is simple; 24 cm long, 19 cm wide. Typically 5-8 eggs; incubation 25-26 days (in captivity); chicks have rufous chestnut down above, greyish white below, with rufous upper breast.

Movements. Believed to be sedentary.

Status and Conservation. ENDANGERED. Mace-Lande: Vulnerable. CITES I. Occurs in areas of SE China with dense human population. Whilst no good information available on abundance, species believed to survive in good numbers at some localities; total population size probably in tens of thousands; fragmented and declining. Known to occur in two natural reserves and possibly in several other small reserves; occurs in Fujian Mountains Endemic Bird Area. Deforestation already considered to have taken a considerable toll on species' habitat, and this continues, together with subsequent conversion of land to agriculture; additional pressure from hunting. Designation of more protected areas needed, and species should be monitored in these areas; reserves should be managed as network. **Bibliography.** Allen, G.A. III (1994), Cheng Tso-hin (1987), Collar & Andrew (1988), Ding Ping & Zhuang Yan (1988, 1989, 1990), Etchécopar & Hue (1978), He Fenshi & Lu (1991), King (1978/79), Knoder (1983), Li Bing-hua (1985), Long Di-zong (1985), Meyer de Schauensee (1984), Shen Jun & Yu Xin-hua (1988), Tang Chan-zhu (1990), Zheng Guang-mei & Zhang Zheng-wang (1993).

136. Hume's Pheasant

Syrmaticus humiae

French: Faisan de Hume German: Burmufasan Spanish: Faisán de Hume

Other common names: Mrs Hume's/Bar-tailed/Black-necked Bar-tailed Pheasant

Taxonomy. *Calophasis humiae* Hume, 1881, Manipur, north-eastern India.

Has been placed in genus *Calophasis*. Two subspecies recognized.

Subspecies and Distribution.

S. h. humiae (Hume, 1881) - mountains of extreme NE India E to R Irawaddy in Burma.

S. h. burmanicus (Oates, 1898) - CS China (SW Yunnan and Guangxi) and E Burma (E of R Irawaddy) SE to N Thailand.



Descriptive notes. Male c. 90 cm (tail 40-53.5 cm), 975-1080 g; female c. 60 cm (tail c. 20 cm), 650-850 g. Distinctive upperwing pattern and blackish blue neck diagnostic in combination. Female resembles that of *S. ellioti*, but paler and has pale fulvous brown throat; mantle feathers barred black with white centres. Immature like female but duller. Male of race *burmanicus* has steel blue of neck slightly more purplish and less extensive than nominate; rump whiter and tail paler.

Habitat. Inhabits open oak-pine forests with scattered clearings above c. 1200 m in Thailand.

Occurs between 1200 m and 2400 m in NE India

and Burma. In Guangxi (CS China), affects evergreen, broad-leaved and mixed forest at 740-1800 m. **Food and Feeding.** In China, race *burmanicus* recorded eating fruits, seeds, leaves, buds and roots of over 40 plant species, including *Pinus yunnanensis*, *Cunninghamia lanceolata*, *Cyclobalanopsis*, *Castanopsis delavayi*, oaks (*Quercus*) and wild mushrooms; some insects taken, but in breeding season plants comprise over 97% (dry weight) of stomach contents; those of young birds contained 50-90% insects (dry weight).

Breeding. Lays Mar; in Guangxi, pairing in early Mar. and mating seen in forest glades. Nests of dried leaves and *Pinus yunnanensis* twigs, liana strands and the bird's body feathers; nest is c. 25-30 cm in diameter. Clutch of 3-12 eggs; incubation 28 days, by female only.

Movements. Stated to move uphill to breed, but altitude limits in each season not reported.

Status and Conservation. RARE. Mace-Lande: *humiae* endangered; *burmanicus* vulnerable. CITES I. Total population estimated to be 1000-10,000 birds; declining. Based on anecdotal information and recent sight records, Thai population estimated to be in low hundreds. In China, 21 sites documented; presence confirmed at 2 sites in Thailand; little recent information from India and none from Burma. Found in Murlum and Blue Mountain National Parks in NE India; may occur in Doi Inthanon National Park in Thailand; not known to occur in any protected area in China. Threatened by habitat loss and degradation, including shortening rotation times of slash-and-burn agriculture in NE India; possibly overhunted for food. Extensive surveys required, especially in Thailand and NE India; further protected areas should also be designated.

Bibliography. Ali & Ripley (1980), Allen, G.A. III (1994), Baker (1928, 1930), Cheng Tso-hin (1987), Collar & Andrew (1988), Davison (1979b), Deignan (1945), Etchécopar & Hue (1978), Gaston (1980a), King (1978/79), Lamba (1980), Lekagul & Round (1991), Liu Xiao-hua *et al.* (1990), Meyer de Schauensee (1984), Round (1988), Sarker (1986), Smythies (1986), Tang Chan-zhu (1990), Zheng Guang-mei & Zhang Zheng-wang (1993).

137. Mikado Pheasant

Syrmaticus mikado

French: Faisan mikado German: Mikadofasan Spanish: Faisán Mikado

Taxonomy. *Calophasis mikado* Ogilvie-Grant, 1906, Mount Arizan, central Taiwan.

Has been placed in genus *Calophasis*. Monotypic.

Distribution. Mountains of C Taiwan.



Descriptive notes. Male c. 87.5 cm (tail 49-53 cm), c. 1300 g; female c. 53 cm (tail 17-22.5 cm), c. 1015 g. Male distinctive; white markings on upperwing- and uppertail-coverts variable; lower back and rump deep black, not bluish. Female resembles that of *S. humiae*, but is darker and more boldly marked with blackish and white. Immature similar to female but head, neck and throat spotted buffy white; in male, tail barred black and white at early stage.

Habitat. Forest with dense undergrowth of rhododendron and bamboo between 1600 m and 3300 m; also found in secondary habitats.

Food and Feeding. No information available.

Breeding. Little reliable information. Season uncertain but laying probably occurs from late Mar to mid-Jul. Nest apparently made of bamboo stalks on trunk or in branches of a fallen tree, c. 1 m off ground. In captivity: 5-10 eggs; incubation 28 days; chicks have pale chestnut, reddish and earthy brown down above, greyish white below.

Movements. No information available.

Status and Conservation. VULNERABLE. Mace-Lande: Safe. CITES I. Yushan National Park (640 km²) recently estimated to hold c. 10,000 individuals; species also known from several other reserves and protected areas. Less threatened by alteration of habitat than sympatric *L. swinhoii*, presumably because inhabits cold temperate forest at higher altitudes; like *L. swinhoii*, present species trapped for bird trade; numbers probably stable where species receives protection, but declining elsewhere. Occurs in Taiwan Island Endemic Bird Area.

Bibliography. Allen, G.A. III (1994), Bridgman (1993), Cheng Tso-hin (1987), Collar & Andrew (1988), Hachisaka & Udagawa (1951), King (1978/79), Poltack (1972), Rong Rong (1984), Sahin (1984), Severinghaus (1977a, 1977b, 1978, 1986), Severinghaus & Blackshaw (1976), Severinghaus & Severinghaus (1990), Tang Chan-zhu (1990), Zheng Guang-mei & Zhang Zheng-wang (1993).

138. Copper Pheasant

Syrmaticus soemmerringii

French: Faisan scintillant German: Kupferfasan Spanish: Faisán Cobreiro
Other common names: Soemmerring's Pheasant

Taxonomy. *Phasianus soemmerringii* Temminck, 1830, Japan (north Kyushu).

Has been placed in monotypic genus *Graphephasianus*. Intergrades between different races reported; races *intermedius* and *subrufus* may be synonymous with race *scintillans*. Hybridization with *Phasianus versicolor* occasionally recorded in the wild, the offspring being infertile. Five subspecies recognized.

Subspecies and Distribution.

- S. s. scintillans* (Gould, 1866) - N & C Honshu, Japan.
S. s. intermedius (Nagamichi Kuroda, 1919) - SW Honshu and Shikoku, Japan.
S. s. subrufus (Nagamichi Kuroda, 1919) - SE & SW Honshu and SW Shikoku, Japan.
S. s. soemmerringii (Temminck, 1830) - N & C Kyushu, Japan.
S. s. iijimae (Dresser, 1902) - SE Kyushu, Japan.



Descriptive notes. Male 87.5-136 cm (tail 48-98 cm); female of race *scintillans* 51-54 cm (tail 14-19 cm); one unsexed adult 907 g. Female resembles that of *S. humiae*, but has darker band on breast; to some extent intermediate between female of *S. humiae* and that of *S. ellioti*. Geographical variation appears to be clinal: males of southernmost races are darker and more richly coloured; much individual variation and some races may not be valid.

Habitat. Occurs in coniferous forest, especially of *Cryptomeria* and cypress, and in mixed forest with dense undergrowth; also in rough country in mountains, but always below 1500 m.

Food and Feeding. Diet consists of acorns and seeds of *Castanopsis*, *Machilus*, *Clevers*, *Castanea* and other forest trees; these are taken from forest floor. Many insect species and earthworms and small crabs also reported; diet of young birds consists mainly of animal matter.

Breeding. Little reliable information. Season from Mar in S. and Apr-May in N. Nest situated on ground, usually sheltered, for instance by a fallen tree. Normally 7 eggs (6-13); incubation 24-25 days (in captivity); chicks have chestnut down above, yellowish buff below.

Movements. No information other than that in N Honshu species is reported to descend to lower altitudes in winter.

Status and Conservation. Not globally threatened. Mace-Land: *soemmerringii*/*iijimae* insufficient information; *scintillans*/*intermedius*/*subrufus* insufficient information. No information available on status other than that at one time species was very common, and nearly 1,000,000 birds were shot each year; nowadays hard to find. There are no estimates of densities or population size, and distribution in protected areas is not documented. Overhunting for sport seems to be main reason for species' decline; if controlled, and birds and habitat are well managed, there seems to be potential for sustainable hunting for sport, "wise use", to play a role in conservation of species. As an island species, any potential threats from introduced predators should be assessed.

Bibliography. Allen, G.A. III (1994), Austin & Kuroda (1953), Brazil (1991), Delacour (1978), Hachisuka (1953), Kiyosu (1965), Kuroda (1926), Ogasawara (1969), Vaurie (1965d), Wayne (1969), Yamashina (1976).

139. Reeves's Pheasant

Syrmaticus reevesii

French: Faisan vénéré

German: Königsfasan

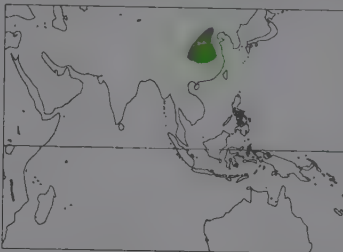
Spanish: Faisán Venerado

Other common names: Bar-tailed/White-crowned Long-tailed Pheasant

Taxonomy. *Phasianus reevesii* J. E. Gray, 1829, China. Monotypic.

Distribution. N & C China, locally from Inner Mongolia S through Shaanxi, Henan, Anhui and N Hubei to Sichuan; range much reduced.

Introduced to several areas, e.g. Britain (possibly extinct), France and Hawaii, but most of these populations are probably not self-sustaining; well established in Czech Republic.



Descriptive notes. Male c. 210 cm (tail 100-160 cm), c. 1529 g; female c. 75 cm (tail 36-45 cm), c. 949 g. Male unmistakable; breast varies from bright chestnut to black. Female has very distinctive head pattern; only female *Syrmaticus* without red bare skin around eyes; variable, sometimes paler than illustration. Immature similar to female but duller and paler.

Habitat. Inhabits woodland and areas of long grass between 200 m and 2600 m.

Food and Feeding. Legumes, acorns, seeds and buds, tubers, radishes and wild persimmons; some larval and adult insects also

taken. In Tuoda Forest, Guizhou, main food items include fruit and seeds of species such as oaks, *Pyracantha fortuneana*, *Rosa maisei* and *Cotoneaster dammeri*; also some insects. Food obtained by scratching ground and digging.

Breeding. In Tuoda Forest, from mid-Apr to mid-Jul. Nest is a shallow bowl lined with pine needles, leaves and herbs; typically on ground in grass or shrubs, in forest. Clutch of 6-9 eggs; incubation 24-25 days; downy chicks are mostly dark brown above, whitish buff below.

Movements. Believed to be fairly sedentary.

Status and Conservation. RARE Mace-Land: Endangered. Probably most threatened pheasant in China. Recent surveys suggest population of 5000; declining. Since mid-1980's, object of much survey and research effort by several Chinese ornithologists from Beijing Natural History Museum and Academia Sinica. Suffered from widespread deforestation in mountains of C China, and this continues; also from overexploitation for various purposes. Historical range has contracted by c. 50%, and species has been absent from N Qinling, Hebei and Shanxi for over 10 years; probably still occurs in Guizhou, NE Yunnan, Sichuan, Shaanxi, S Gansu, Hunan, Henan, Hubei and Anhui, but all populations small, with 20-50 birds recorded at many sites. Now known from four or possibly five reserves, some of which are very small. Largest population may be in Tuoda Forest Reserve of Reeves's Pheasant, created in May 1992 as a result of research and conservation efforts by Wu Zhi-kang. With so many populations comprising so few birds, regular, preferably annual, monitoring is very important, as is assessment of ecological requirements, so that effective management can be initiated. Establishment of network of protected areas is badly needed, combined with a public awareness programme which could use present species as flagship for habitat conservation. Tail feathers have long been used in head-dresses in traditional Peking Opera performances; a captive population in China could satisfy this culturally important market.

Bibliography. Allen, G.A. III (1994), Cheng Tso-hin (1963, 1987), Collar & Andrew (1988), Eichendorp & Hüc (1978), He Fen-qi & Lu (1991), Hu Xian-long & Wang Qi-shan (1981), Hsu Wei-shu (1989), King (1992), Knoder & Bailie (1956), Lever (1987), Meyer de Schauensee (1984), Tang Chan-zhu (1990), Vaurie (1965d), Wu Zhi-kang (1979b), Wu Zhi-kang & Hsu Wei-shu (1986), Wu Zhi-kang & Xu Wei-shu (1987), Wu Zhi-kang *et al.* (1993), Xu *et al.* (1990), Zheng Guang mei & Zhang Zheng-wang (1993).



PLATE 57

Family PHASIANIDAE (PHEASANTS AND PARTRIDGES) SPECIES ACCOUNTS

Genus *PHASIANUS* Linnaeus, 1758

140. Ring-necked Pheasant

Phasianus colchicus

French: Faisan de Colchide German: Fasan
Other common names: Common Pheasant

Spanish: Faisán Vulgar

Taxonomy. *Phasianus colchicus* Linnaeus, 1758, Africa, Asia = Rion River. Sometimes considered conspecific with *P. versicolor*, which is thus relegated to subspecies level; however, the two are not now generally regarded as conspecific, because present species, when introduced to Japan, is apparently unable to survive, presumably due to competition with *P. versicolor*, and failure to hybridize successfully; nevertheless, they hybridize extensively where both introduced in Hawaii. Internal taxonomy of species requires extensive revision. Populations of E-Asia sometimes considered to constitute a separate species, *P. torquatus*. Races currently accepted can be split into five or six groups, which may be a better guide to geographical variation. Thirty-one subspecies recognized.

Subspecies and Distribution.

P. c. septentrionalis Lorenz, 1888 - N Caucasus.
P. c. colchicus Linnaeus, 1758 - Transcaucasia, in E Georgia, NE Azerbaijan, S Armenia and NW Iran.
P. c. talischensis Lorenz, 1888 - SE Transcaucasia.
P. c. persicus Severtsov, 1875 - SW Transcaucasia.
P. c. bergii Zarudny, 1914 - islands of Aral Sea.
P. c. turkestanicus Lorenz, 1896 - Kazakhstan (valley of R Syrdar'ya).
P. c. mongolicus J. F. Brandt, 1844 - NE Russian Turkestan.
P. c. principalis P. L. Sclater, 1885 - S Russian Turkestan and N Afghanistan.
P. c. chrysomelas Severtsov, 1875 - Turkestan (upper R Amud ar'ya).
P. c. zerafschanicus Tamovskii, 1893 - S Uzbekistan (Bukhara, Zerafshan Valley).
P. c. zarudnyi Buturlin, 1904 - Turkestan (valleys of C Amud ar'ya).
P. c. bianchii Buturlin, 1904 - Turkestan (Amud ar'ya Delta).
P. c. shawii Elliot, 1870 - Chinese Turkestan.
P. c. tarimensis Pleske, 1888 - CE Chinese Turkestan.
P. c. hugenbecki Rothschild, 1901 - NW Mongolia.
P. c. edzinensis Sushkin, 1926 - SC Mongolia.
P. c. satscheuensis Pleske, 1892 - NC China (extreme W Gansu).
P. c. vlangalii Przevalski, 1876 - NC China (N Qinghai).
P. c. alaschanicus Alphéraky & Bianchi, 1908 - NC China (W foothills of Helan Shan).
P. c. sohokhotensis Buturlin, 1908 - NC China (Sohokhot Oasis in Helan Shan; possibly also this race in Qilian Shan).
P. c. pallasi Rothschild, 1903 - SE Siberia and NE China.
P. c. karpowi Buturlin, 1904 - NE China (S Manchuria and N Hebei) and Korea.
P. c. kiangsuenis Buturlin, 1904 - NE China (N Shanxi and Shaanxi) and SE Mongolia.
P. c. strachii Przevalski, 1876 - C China (S Shaanxi and S & C Gansu).
P. c. sueshanensis Bianchi, 1906 - WC China (NW Sichuan).
P. c. elegans Elliot, 1870 - WC China (W Sichuan).
P. c. decollatus Swinhoe, 1870 - C China (Sichuan E to W Hubei and S to NE Yunnan and Guizhou).
P. c. torquatus Gmelin, 1789 - E China (Shandong S to China-Vietnam border).
P. c. rothschildi La Touche, 1922 - SC China (E Yunnan) and N Vietnam.
P. c. takatsukasae Delacour, 1927 - S China (S Guangxi) and N Vietnam.
P. c. formosanus Elliot, 1870 - Taiwan.

Various races introduced into many different countries, especially in Europe, North America, Australia (unsuccessfully), Tasmania and New Zealand.



Descriptive notes. Male 75-89 cm (tail 42.5-59 cm), 770-1990 g; female 53-62 cm (tail 29-31 cm), 545-1453 g; wingspan 70-90 cm. Male highly variable according to race, but usually not as dark as male *P. versicolor*; has longer tail, and at least some coppery colouring on underparts. Female differs from that of *P. versicolor* in paler, less blotched and vermiculated plumage. Immature resembles female, but duller and has shorter tail. Considerable geographical variation in many aspects of male plumage, partly clinal, partly not; white ring on neck usually absent in W, present in most of E races. Five subspecies

groups normally identified on basis of male plumage; white wing-coverts distinguish both *mongolicus* group (with more coppery upperparts), and *chrysomelas/principalis* group (with a more orange or yellowish tinge on upperparts); brown or buff wing-coverts distinguish *colchicus* group (with reddish brown rump), *tarimensis* (with yellowish cast on green rump), and *torquatus* group (with greyish or bluish cast on green rump); within each group, species differ in colour of head and neck gloss, and in other details of plumage.

Habitat. Considerable variation in habitat throughout natural range. Mainly overgrown edges of rivers, hilly areas close to cultivation and flat land under cultivation.

Food and Feeding. In natural range, diet consists primarily of plant matter, with much less animal food: fruits, seeds, leaves, buds and insects in autumn; fresh buds, grasses, leaves, insects and small invertebrates in spring; birds seen flying into grain fields to feed. Where introduced, a very diverse diet has been described, depending on local and seasonal food availability, indicating opportunism and omnivorous tendency; prefers large, energy-rich kinds of food, e.g. cultivated grains, mast and fruits.

Breeding. Season believed to be highly variable throughout both native and introduced ranges. In Jiangsu, CW China, harems of 3-5 females form from mid-Feb; in Azerbaijan, laying in Apr-May. Nest is a shallow depression in ground, lined with plant material from vicinity of nest, or unlined; clutch of 9-14 eggs; incubation 22 days. Where introduced, and more studied: normally 7-14 eggs (1-28); incubation 23-25 days; chicks have cinnamon and buff down above, with central broad black streak, pale creamy buff below.

Movements. Only information from native range is of several mass-migrations, mainly involving adult males moving from China into Amur Basin, E Russia, in severe winters. In introduced range, sedentary, although birds may move locally to feed on more open habitats during non-breeding season.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Only one reliable density estimate from any part of native range: at Panguangou National Nature Reserve in 1989, an estimated autumn density of 64 birds/km², a density similar to that found on managed estates in Britain. Other reports state that it is commonest game bird in China, given its wide distribution and tolerance of a wide variety of habitats; possibly tens of millions of birds in the wild; declining in some areas, but stable at most sites. Extensively hunted, both for food and sport, and suffering from agricultural intensification in some areas, but still widely distributed outside protected areas. Population declining in Taiwan, fairly common in E and S, but scarce in NW, disappeared from some lowland areas which have been lost to development. In late 1940's was common in NE Burma, but no recent data. Very little information available about status in W part of natural range. In Azerbaijan, nominate *colchicus* is common resident, with population of c. 20,000-25,000 individuals; race *tarimensis* is very rare resident, with only c. 200-300 individuals, following decline due to habitat loss and uncontrolled hunting, which together have brought it to brink of extinction, in 1940's and 1950's, estimated c. 40,000 birds killed by hunters each year. Common to superabundant in many parts of introduced range, where wild populations frequently bolstered by large numbers of captive-bred birds for shooting.

Bibliography. Austin & Oates (1971), Austin (1948), Harvey (1983), Baranovich (1965), Bohl (1964), Briggs *et al.* (1992), Buturlin (1904), Cheng Tsao-hsin (1963, 1987), Cramp & Simmons (1980), Demeines & Gladkov

(1952), Deng Wei-jie (1990), Etchecopar & Hue (1978), Flint *et al.* (1984), Gates (1966), Glutz von Blotzheim *et al.* (1973), Grunnet & Taylor (1992), He Fen-qi & Cui Xue-zhen (1990), He Fen-qi *et al.* (1990), Hill & Ridley (1987), Hill & Robertson (1988), Huang Er-wen (1985), Kimball (1949), King & Peng Ji-tai (1991), Kozicky (1952), Kozlowa (1947), Kuroda (1981), Kuz'mina (1992), Lever (1987), Liu Nan-fa & Wang Xiang-ting (1986), Liu Nan-fa *et al.* (1984), Manson (1987), Marchant & Higgins (1993), Nguyen Cu & James (1993), Ogurli (1993), Patrikees (1993), Piao Ren-zhu *et al.* (1984), Potapov & Flint (1989), Ridley (1983), Ridley & Hill (1987), Robertson (1990), Robertson & Carroll (1989), Schwartz & Schwartz (1951), Scott & Howell (1976), Simeonov *et al.* (1990), Smythies (1986), Tang Chan-zhu (1990), Trautman (1982), Vaurie (1965d), Wang & Yang Xue-ming (1993), Wen Xian-ji & Yang Lan (1990), Wu Zhi-kang (1979a), Yan An-huo (1990), Zhang Zheng-wang *et al.* (1993), Zhao Zheng-Jie (1990), Zheng Guang-mei & Zhang Zheng-wang (1993).

141. Green Pheasant

Phasianus versicolor

French: Faisan versicolore

German: Buntfasan

Spanish: Faisán Verde

Other common names: Japanese Pheasant

Taxonomy. *Phasianus versicolor* Vieillot, 1825. Java; error = Japan.

May be conspecific with *P. colchicus*, but in Japan the latter apparently dies out when introduced in range of present species, as seems unable to hybridize successfully; nevertheless, they hybridize extensively, where both introduced in Hawaii. Hybridization with *Symnaticus soemmerringii* occasionally recorded in the wild. Three subspecies recognized.

Subspecies and Distribution.

P. v. versicolor Vieillot, 1825 - SW Honshu and Kyushu, Japan.

P. v. tanensis Nagamichi Kuroda, 1919 - EC Honshu (Izu and Miura Peninsulas) and nearby Izu Is. and Tanegashima and Yakushima (off S Kyushu), Japan.

P. v. robustipes Nagamichi Kuroda, 1919 - Sado and most of Honshu, Japan.

Introduced to Hawaii.



Descriptive notes. Male c. 81.5 cm (tail 27-42.5 cm), 900-1400 g; female c. 58 cm (tail 21-27.5 cm), 692-970 g. Male differs from that of *P. colchicus* by shorter tail and usually much darker plumage, all dark green below; a grey morph is said to exist. Female differs from that of *P. colchicus* by more blotched and vermiculated underparts, blacker and more contrasted markings on mantle, and shorter tail. Immature similar to adult female. Races vary slightly in general colour tone of male's plumage, and in intensity of scaling on breast feathers.

Habitat. Occurs in park and farmland, areas of bush and open woods on plains and in relatively low hills, up to c. 1000 m; nests from sea-level up to 900 m.

Food and Feeding. Diet believed to be similar to that of *P. colchicus*, but possibly with higher proportion of wild seeds, fruits, berries and nuts, and fewer cultivated grains. Fruits identified include those of *Rosa*, *Elaeagnus*, *Viburnum*, *Viscum* and *Diospyros*; mast includes acorns, chestnuts and seeds of Japanese magnolias.

Breeding. Probably Apr-May in C Japan. Nest placed in cover on ground, usually close to low bushes or at base of tree. Clutch of 6-12 eggs (up to 15); incubation 23-25 days; downy chicks are strongly marked, and generally similar to those of *P. colchicus*.

Movements. Only information is of some seasonal movements in high snowfall areas of N Honshu. Apparently performs daily movements associated with feeding.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Declared Japan's national bird in 1947; familiar to people in legends, and prized by hunters. No density estimates available, but in early 1980's it was reported that over 100,000 captive-reared birds were released each year, and that annual bag was of over 500,000 birds. Shooting of females is prohibited; numbers of males killed has not dropped, unlike the case of *S. soemmerringii*.

Bibliography. Austin & Kuroda (1953), Bohl (1964), Brazil (1991), Buturlin (1904), Delacour (1978), Endo (1982), Goodwin (1982), Hachisuka (1953), Kiyosu (1965), Kuroda (1926, 1981), Ogasawara (1969), Raethel (1988), Schwartz & Schwartz (1951), Vaurie (1965d).

Genus CHRYSOLOPHUS J. E. Gray, 1834

142. Golden Pheasant

Chrysolophus pictus

French: Faisan doré

German: Goldfasan

Spanish: Faisán Dorado

Taxonomy. *Phasianus pictus* Linnaeus, 1758. China.

Monotypic.

Distribution. C China, from SE Qinghai and S Gansu E through S Shaanxi to W Henan and W Hubei, and S through Sichuan and Guizhou to N Guangxi.

Introduced very locally to England.

Descriptive notes. Male 100-115 cm (tail 63-79 cm), 575-875 g; female 61-70 cm (tail 34-37.5 cm), 550-700 g; wingspan 65-75 cm. Male unmistakable. Female differs from that of *C. amherstiae* by velvety legs and ornate skin, more golden tone to plumage, and more pointed tail feathers. Immature like female but paler and less distinctly barred.

Habitat. Inhabits mountains and valleys with thick undergrowth of shrubs and bamboo.

Food and Feeding. Diet consists primarily of leaves and tender shoots of shrubs, leaves and shoots of bamboo, and rhododendron flowers; also some spiders and various insects taken.

Breeding. Little known. Believed to start breeding in early Apr; one clutch apparently found in bamboo grove with tall herbs and rocky outcrops, lays 5-11 eggs (introduced populations incubation 22 days; chicks have fulvous brown down above, with pale buff bands, buffy white below, but somewhat yellower than those of *C. amherstiae*).

Movements. Seasonal movements are probably fairly limited.



Status and Conservation. Not globally threatened. Mace-Lande: Safe. Population estimated in hundreds of thousands at many sites, but declining. Timber extraction, capture for live bird trade, and overexploitation for food are all contributing to drop in numbers; considered an expensive delicacy in restaurants. Known from several protected areas where hunting and deforestation are prevented.

Bibliography. Baker (1965), Cheng Tso-hin (1963, 1987), Cramp & Simmons (1980), Deng Wei-jie (1990), Eichécopar & Hùe (1978), He Fen-qí & Cui Xie-zhen (1990), Hu Tie-qing *et al.* (1988), Lever

(1987), Li Fu-lai & Huang Shi-qiang (1985b), Li Xiang-tao (1988), Meyer de Schauensee (1984), Pang Bing-zhang (1964, 1990), Tang Chan-zhu (1990), Vaurie (1965d), Wen Xian-ji & Yang Lan (1990), Wu Zhi-kang (1980), Zhao Xuan (1956), Zheng Guang-mei & Zhang Zheng-wang (1993).

143. Lady Amherst's Pheasant

Chrysolophus amherstiae

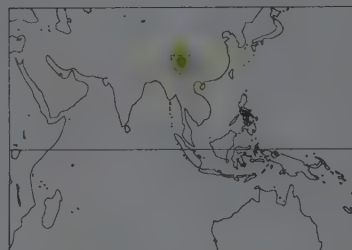
French: Faisan de Lady Amherst **German:** Diamantfasan **Spanish:** Faisán de Lady Amherst

Taxonomy. *Phasianus Amherstiae* Leadbeater, 1829. Mountains of CochinChina; error = Yunnan. Monotypic.

Distribution. NE Burma, extreme SE Tibet and SW China (from W Sichuan S to Yunnan and W Guizhou).

Introduced very locally to British Is.

Descriptive notes. Male 130-173 cm (tail 83-115 cm), 675-850 g; female 66-68 cm (tail 28-37 cm), 624-804 g; wingspan 70-85 cm. Male unmistakable. Female differs from that of *C. pictus* by



bluish grey legs and orbital skin, richer rufous tone to plumage, and more rounded tail feathers. Immature similar to female but paler and less distinctly barred.

Habitat. Inhabits wooded hills and bamboo, dense shrub patches and thickets; occurs between 2100 m and 3600 m, usually at higher altitudes than *C. pictus*.

Food and Feeding. Two crops contained many earwigs of various species, spiders, small beetles and fern fronds; also bamboo sprouts, which appear to be a preferred food item. Chicks recorded feeding on fruits of *Rubus*, *Coria sinica* and *Vaccinium spregelii*.

Breeding. Data from C Yunnan (S China). Lays from mid-Apr; males territorial in evergreen coniferous and secondary pine (*Pinus armandi*) forest from mid-Mar. Nest is round and shallow, lined with dead leaves, and situated under thicket or dead branches. Four nests contained 6 eggs, one contained 7 eggs; incubation 24 days, by female only; chicks have fulvous brown down above, with pale buff bands, buffy white below.

Movements. Probably performs substantial altitudinal movements, given high altitudes at which occurs in summer. Reported from foothills during severe weather.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Based on intensive field-work in China and surveys elsewhere, total population estimated in tens of thousands. Not common along Ngawchang Valley, NE Burma, in late 1940's. Habitat believed to be suffering from variety of pressures and becoming increasingly fragmented; species is also subject to overexploitation for food.

Bibliography. Baker (1930, 1965), Bland & Han (1993), Cheng Tso-hin (1963, 1987), Cramp & Simmons (1980), Eichécopar & Hùe (1978), Han Lian-xian *et al.* (1988, 1989, 1990), He Fen-qí *et al.* (1990), He Fen-qí & Cui Xie-zhen (1990), King, B.F. (1989a, 1989b), Lever (1987), Meyer de Schauensee (1984), Phillips (1921), Smythies (1986), Tang Chan-zhu (1990), Vaurie (1965d), Wen Xian-ji & Yang Lan (1990), Yang Jiong-li *et al.* (1981), Zheng Guang-mei & Zhang Zheng-wang (1993).

inches 10
cm 25

PLATE 58

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144

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146

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147

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ssp katsumatae

ssp bicalcaratum

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Genus *POLYPLECTRON*

Temminck, 1813

144. Bronze-tailed Peacock-pheasant

Polyplectron chalcurum

French: Éperonnier à queue bronzée Spanish: Espolonero Colibronceado
German: Bronzeschwanzfasan
Other common names: Sumatran/Lesson's Peacock-pheasant

Taxonomy. *Polyplectron chalcurum* Lesson, 1831, Java; error = Bengkulu, west Sumatra. Formerly placed in genus *Chalcus* together with *P. inopinatum*. Validity of race *scutellatum* has been questioned, as differences are slight and are masked by considerable variation between individuals. Two subspecies recognized.

Subspecies and Distribution.

P. c. scutellatum Chasen & Hoogerwerf, 1941 - mountains of N Sumatra.
P. c. chalcurum Lesson, 1831 - mountains of S Sumatra.



Descriptive notes. Male c. 56 cm (tail 26-38 cm), 370-590 g; female c. 40 cm (tail 18-22 cm), 238-269 g. Only member of genus in which both sexes have no ocelli at all; instead, tail has metallic purplish violet patches near the tip. Female similar to male, but considerably smaller, with much shorter tail. Immature resembles adult, but slightly paler and redder, with less bluish purple on tail; in first-year male the iridescent patches may reach tail tip. Race *scutellatum* said to be more strongly marked above than *chalcurum*, although this may be confounded by extensive individual variation.

Habitat. Inhabits variety of lower montane forest habitats, including both undisturbed and logged forest; also recorded in small remnant patch of forest; occurs between 800 m and 1700 m throughout mountains of Sumatra.

Food and Feeding. Several crops contained small fruits and insects. No further information available.

Breeding. No information from the wild. In captivity: clutch of 2 eggs; incubation 22 days; chicks have blackish brown down above, brownish buff below.

Movements. No information available.

Status and Conservation. Not globally threatened. Mace-Land: Vulnerable. Recent records at several sites in N & C Sumatra, from Ketambe (Gunung Leuser) S to Mt Kerinci; fairly common in places, e.g. Padang Highlands. Found in montane forests, which are still widespread and fairly secure. Based on anecdotal information and available habitat, population is estimated to number tens of thousands; thought to be declining in some areas, e.g. Brestagi, due to hunting and trapping, but overall regarded as probably safe in short term, mainly because occupies mountainous terrain, and also because seems to tolerate certain degree of disturbance to habitat. Occurs in both Kerinci-Seblat National Park (15,000 km²) and Gunung Leuser National Park (7927 km²), with several fairly recent reports from both. Up to 50% of what is believed to be suitable habitat is already covered by some form of protection status. Species has restricted range, occurring in Sumatra and Peninsular Malaysia (above 600 m) Endemic Bird Area. Habitat degradation and loss, and in places overexploitation are main threats. Not protected by Indonesian law.

Bibliography. Andrew (1992), van Balen & Holmes (1993), Davison (1985a, 1985c, 1986c), Holmes (1989), MacKinnon & Philipps (1993), van Marle & Voous (1988), McGowan (1992a), Robinson & Kloss (1918, 1924), Roles (1990), Searle (1986, 1989), Wells (1985).

145. Mountain Peacock-pheasant

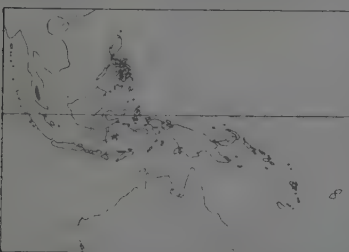
Polyplectron inopinatum

French: Éperonnier de Rothschild Spanish: Espolonero de Rothschild
German: Rothschildpfaufasan
Other common names: Rothschild's/Mirror/Malayan Peacock-pheasant

Taxonomy. *Chalcus inopinatus* Rothschild, 1903, Ulu Pahang, Peninsular Malaysia.

Formerly placed in genus *Chalcus* together with *P. chalcurum*. Monotypic.

Distribution. Mountains of Main Range, Peninsular Malaysia.



Descriptive notes. Male c. 65 cm (tail 32-40 cm); female c. 46 cm (tail 22-27.5 cm). Characteristic contrast between mainly chestnut mantle, wings and back, and greyish black underparts and head. Male has very small blue ocelli (with a white spot at the base of each ocellus) on mantle and wings. Female resembles male but considerably smaller, with shorter tail; ocelli on upperparts replaced by black spots. Immature similar to adult female, but male is longer-legged.

Habitat. Occurs throughout unlogged upper dipterocarp forest, and both lower montane and upper montane forest, from 900 m up to 2000 m.

Food and Feeding. One crop contained spiders, white ants, several grubs and other unidentified animal material; also reports of birds having consumed other invertebrates and fruits of rattan *Calamus*. No further information available.

Breeding. Very little information from the wild: an old nest found at altitude of 970 m, placed among rocks between two fallen trees; small chick collected in late Feb. In captivity: clutch of 2 eggs; incubation 19-21 days; chicks have rufous down above, buff below.

Movements. No information available.

Status and Conservation. Not globally threatened. Mace-Land: Vulnerable. Based on anecdotal information and extent of habitat available, population is estimated to be in the thousands, and probably stable or declining slightly. Present in Fraser's Hill (30 km²) and Cameron Highlands (649 km²) Wildlife Sanctuaries, Krau Wildlife Reserve (530 km²) and Taman Negara National Park (4343 km²). Species has restricted range, occurring in Sumatra and Peninsular Malaysia (above 600 m) Endemic Bird Area. Threatened by habitat destruction for agriculture and possibly also by urban development. Major threat is the possibility of a road linking the hill stations of Genting Highlands, Fraser's Hill and Cameron Highlands, which would destroy much montane forest along Main Range. An international studbook and breeding consortium was initiated during 1992 and is co-ordinated by New York Zoological Society/Wildlife Conservation International and Department of Wildlife and National Parks, Peninsular Malaysia: the captive population comprised 111 individuals in Feb 1993. CITES III in Malaysia.

Bibliography. Benning & Sui Hwa Yatim (1992), Davison (1985a, 1986c, 1992), Davison & Searle (1987), Denham (1978), Gibson-Hill (1949), McGowan (1992a) Medway & Wells (1976), Roles (1990), Searle (1986, 1989), Sui Hwa Yatim (1993), Welk (1985, 1990).

146. Germain's Peacock-pheasant

Polyplectron germaini

French: Éperonnier de Germain Spanish: Espolonero de Germain
German: Brauner Pfauasan

Taxonomy. *Polyplectron germaini* Elliot, 1866, Cochinchina.

Sometimes considered to form a superspecies with *P. bicalcaratum*. Monotypic.

Distribution. S Vietnam N to 14° N, in SC Annam. Reports claiming that species also occurs in Kampuchea and Thailand are disputed.



Descriptive notes. Male c. 56 cm (tail 25-32 cm), one bird 510 g; female c. 48 cm (tail 22-25 cm), one bird 397 g. Male differs from those of other *Polyplectron* with large ocelli on upperparts by lack of crest or ruff, the ocelli on the mantle and wings are surrounded by a pale, golden brown ring. Female smaller and slightly duller; the blue ocelli on the mantle and wings are somewhat triangular, while the green ocelli on the tail lack the pale border. Immature similar to adult female, but has ocelli blackish.

Habitat. Found in lowland and sub-montane forests; also seen in thorny bamboo brakes. Appears to tolerate a certain degree of habitat disturbance, and has been recorded in both logged and secondary forest.

Food and Feeding. No information available.

Breeding. No reliable information available from the wild. In captivity: clutch of 1-2 eggs; incubation 21 days; chicks have dark chestnut brown down on upperparts, more buff-coloured on underparts.

Movements. No information available.

Status and Conservation. RARE. Mace-Land: Vulnerable. CITES II. Very little recent information available; heard daily in Nam Bai Cat Tien National Park (350 km²) during surveys in early Jan 1990; appears to tolerate some habitat disturbance. Anecdotal information suggests a wild population of less than 10,000 individuals, which is probably declining. Species has restricted range, occurring in Cochinchina Endemic Bird Area. Threatened by overexploitation for food, and also by habitat destruction for agriculture. More information is required on degree of security afforded by protected areas.

Bibliography. Anderson (1993), Collar & Andrew (1988), Davison (1985a, 1986c), Eames *et al.* (1992), Hing (1985), Lowe (1925), McGowan (1992a), Nguyen Cu & Eames (1993), Riley (1938), Robson *et al.* (1993, 1993b), Roles (1990), Searle (1986, 1989), Wayne (1969), Wildash (1968).

147. Grey Peacock-pheasant

Polyplectron bicalcaratum

French: Éperonnier chinquois German: Grauer Pfauasan Spanish: Espolonero Chinquois
Other common names: Iris/Chinquois Peacock-pheasant

Taxonomy. *Pavo bicalcaratus* Linnaeus, 1758, China; error = Thoungyah, Burma.

Sometimes considered to form a superspecies with *P. germaini*. Five subspecies recognized.

Subspecies and Distribution.

P. b. bakeri Lowe, 1925 - hills of NE India and Bhutan, from Sikkim E to Manipur, and maybe on into Burma.

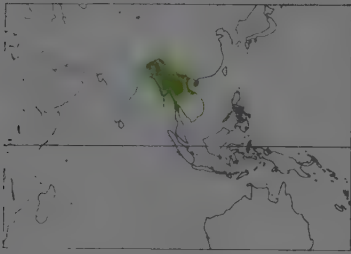
P. b. baileyi Lowe, 1925 - unknown; thought to occur in W Assam or E Himalayas.

P. b. bicalcaratum (Linnaeus, 1758) - W & S Burma E through CS China (W Yunnan) to NW Vietnam and SE to SW Thailand (N of Isthmus of Kra).

P. b. ghigii Delacour & Jabouille, 1924 - N & C Vietnam and C Laos.

P. b. katusmatiae Rothschild, 1906 - Hainan I (S China).

Descriptive notes. Male 56-76 cm (*bicalcaratum*, *bakeri*); c. 53 cm (*katusmatiae*), tail 35-40 cm (*bakeri*), 28-30 cm (*katusmatiae*); 568-910 g (*bakeri*). Female 48-55 cm (*bicalcaratum*, *bakeri*), c. 40 cm (*katusmatiae*), tail 23-25.5 cm (*bakeri*), 17-19 cm (*katusmatiae*); c. 400 g (*katusmatiae*). Male has a full crest that wings spread, dips forward over neck, crest of ocelli on mantle and wings is surrounded by a white ring. Female resembles male, but smaller, with shorter crest; plumage generally darker and duller, and ocelli small and blackish, with white reflections. Immature similar to adult female, but male has longer legs. Races differ in general coloration of male, greyer in W, browner in E, and in size; easternmost race *katusmatiae* is smallest.



Habitat. Inhabits dense evergreen and semi-evergreen forest up to 1300 m, up to 1800 m in Thailand. Race *katsumatae*, at least, can survive in secondary habitats, but probably only in mature secondary forest.

Food and Feeding. Diet apparently consists of berries, fruits (plums and *Zizyphus* identified), seeds, wild figs, grubs, ants, other insects, snails and other small animals; particularly favours termites; bamboo seeds eaten when available. As are rice and grain from village cultivation. Foraging slow and secretive, birds scratching for food in quiet manner.

Breeding. In NE India. Mar-Jun, mainly Apr-May; in Bangladesh, Apr-May. Nest located in a hollow, usually at base of bamboo clump or in thick bushes; tangles of secondary vegetation apparently favoured. Clutch probably consists of 2 eggs, but reliable data lacking; incubation 21 days (in captivity); chicks have dark brown down above, tawny buff below.

Movements. No information available.

Status and Conservation. Not globally threatened. Mace-Lande: *bicalcaratum/bakeri/bailiyilghigii* safe; *katsumatae* endangered. CITES II. Very little firm information available from NE India and Bhutan, but species probably present in protected tropical forest in NE India; suitable habitat still likely to exist in Bhutan; rare breeding resident in Bangladesh. In China believed to be very rare and declining overall; extent of range is decreasing in Hainan, but possibly expanding in Yunnan. In Thailand, widely distributed and fairly common in best protected and largest areas; population estimate in thousands; may be stable or slightly declining. No recent information from Burma or Laos, but formerly considered very common in N Burma and Tenasserim and common everywhere else in suitable habitat, except for Pegu Yomas. Recently reported from several sites in Vietnam, including Bach Ma National Park. Main pressures are those to habitat, although overhunting is also a problem. Hainan race, *katsumatae*, is considered worthy of special conservation attention because of morphological differences with the continental races, and geographical isolation from them; known from three natural reserves in Hainan, but their effectiveness in terms of protecting species is uncertain; at least one, Ba Wang Ling (20 km²) is probably not effective.

Bibliography. Ali & Ripley (1980), Anderson (1993), Baker (1928, 1930, 1935), Cheng Tso-hin (1987), Davison (1985a, 1986c), Deignan (1945), Eichéopar & Hue (1978), Flieg (1973), Gao Yu-ren (1991), Humphrey & Bain (1990), Inskipp & Inskipp (1993b), Kaul & Ahmed (1993), Lamba (1980), Lekagul & Round (1991), Lowe (1925), McGowan (1992a), Meyer de Schauensee (1984), Mukhim & Michael (1993), Nguyen Cu & Eames (1993), Pocock (1911), Robinson & Kloss (1921), Robson *et al.* (1989, 1993a, 1993b), Roles (1990), Sarker (1986), Searle (1986, 1989), Smythies (1986), Stapel (1976), Tang Chan-zhu (1990), Zheng Guang-mei & Zhang Zheng-wang (1993).

148. Malaysian Peacock-pheasant

Polyplectron malacense

French: Éperonnier malais German: Malaienpfaufasan Spanish: Espolonero Malayo
Other common names: Malay(an)/Crested Peacock-pheasant

Taxonomy. *Pavo malacensis* Scopoli, 1786, East Indies = Malacca.

Forms superspecies with *P. schleiermacheri* and possibly *P. emphanum*. *P. schleiermacheri* has been considered race of present species. Monotypic.

Distribution. Malay Peninsula (almost exclusively S of Isthmus of Kra) in extreme S Burma, S Thailand and Peninsular Malaysia. Possibly extinct in Thailand. Sumatra has traditionally been included in species' distribution, but there is no evidence to support this claim.



Descriptive notes. Male c. 50 cm (tail 24-25 cm); female c. 40 cm (tail 18-19 cm); c. 586-680 g. Male has long crest of disintegrated feathers; each ocellus on the mantle and wings is surrounded by buff; tail proportionately much shorter than in *P. bicalcaratum*. Female has much shorter crest, and ocelli on mantle and upperwing-coverts replaced by triangular black spots. Immature similar to female, with black spots on wings.

Habitat. Occurs in evergreen rain forest in level lowlands. Inhabits forest dominated by tall dipterocarp trees on flat or gently undulating ground. Upper altitude limit appears to be c. 150 m, but birds may exceptionally be found up to 300 m. Has been recorded in secondary forest, but tolerance of habitat alteration is probably limited.

Food and Feeding. Diet largely unknown, but species is probably opportunistically insectivorous, frugivorous, or both. Faeces and stomach contents include invertebrate and plant material: parts of anthropod and grasshopper, ants (*Camponotus*) and Diptera; also fruits (Fagaceae; *Lithocarpus*, Annonaceae and Leguminosae), moss, twigs, roots and the corolla of an Aponynaceae flower. Feeds by scratching in leaf litter and picking up food items from forest floor; also pecks at low-flying insects.

Breeding. Breeding season uncertain. Males call and maintain display scrapes, which are areas of forest floor cleared of leaf litter; both activities performed unpredictably and infrequently, possibly in relation to fluctuations in food supply. Only four nests have been described: in Mar. Apr and Aug in different years; two nests were simple, one a slight depression on top of a termite mound, and the other involved an egg-laid directly onto leaf litter amongst understorey plants. The only pheasant species definitely known to lay a clutch of 1 egg; incubation 22-23 days (in captivity); chicks have rather pale chestnut brown down above, buff below.

Movements. Appears to be sedentary. Bimonthly home range of three non-calling males was 10.8-58.3 ha, and of females 7.3-25.8 ha. Shifts of core area occurred within this home range.

Status and Conservation. Not globally threatened Mace-Lande: Vulnerable. CITES II. Survival of species probably depends upon future of lowland primary forest below 300 m (or maybe 150 m) in Peninsular Malaysia; one possible site in Thailand, no recent information from Burma. Based on recent fieldwork and extent of habitat remaining, population estimated to be in the thousands. Species present in Taman Negara National Park (4343 km²), Krau Wildlife Reserve (530 km²), Sungai Dusun Wildlife Reserve (45 km²), Sungai Wildlife Reserve (25 km²) and Pasoh Forest Reserve (25 km²). It seems likely that at most 50-70% of the area included within these reserves supports habitat below 300 m, within the species' altitude limits. Restricted range; species occurs in a low priority Endemic Bird Area. Overexploitation for food, sport and bird trade have con-

tributed towards (near) elimination of species in Thailand; these threats are not currently of consequence throughout rest of species' distribution. In Peninsular Malaysia, habitat is becoming fragmented, due to conversion of forest to agricultural land, and species will probably be confined to five protected areas in future; three of these areas are small. An international studbook of captive individuals is maintained by New York Zoological Society/Wildlife Conservation International; this records 189 individuals in 35 institutions in 1993.

Bibliography. Baker (1928), Brunning (1977, 1983b), Chasen (1939), Collar & Andrew (1988), Davison (1979a, 1983a, 1983b, 1985a, 1986c), Davison & Scriven (1987), Gibson-Hill (1949), Holmes & Burton (1987), Humphrey & Bain (1990), Johns (1986, 1989), Lekagul & Round (1991), van Marle & Voous (1988), McGowan (1991, 1992a, 1993, 1994b), Medway & Wells (1976), Riley (1938), Robinson & Kloss (1921), Roles (1990), Round (1988), Searle (1986, 1989), Siti Hawa Yatim (1993), Smythies (1986), Stapel (1976), Wells (1985, 1990).

149. Bornean Peacock-pheasant

Polyplectron schleiermacheri

French: Éperonnier de Bornéo German: Borneopfaufasan Spanish: Espolonero de Borneo

Taxonomy. *Polyplectron schleiermacheri* Brüggemann, 1877, south-eastern Borneo.

Has been considered a race of *P. malacense*, but a phylogenetic analysis of male morphology indicates that it is better treated as a full species. Forms superspecies with *P. malacense*; some authors also include *P. emphanum*. Monotypic.

Distribution. Borneo. Exact distribution uncertain.



Descriptive notes. Male c. 50 cm (tail c. 20 cm); female c. 35.5 cm (tail c. 15.5 cm). Male has throat and centre of breast pure white, and metallic blue-green sides of breast; upperparts more rufous than in *P. malacense*, with smaller ocelli. Female lacks distinctive head markings, apart from white throat; more reddish than female *P. malacense*, with shorter tail; lacks ocelli on uppertail-coverts, and has smaller, ill defined ocelli on rectrices.

Habitat. Occurs in primary lowland forest, and is possibly limited to that lying on riverine alluvium in valleys.

Food and Feeding. No information available.

Breeding. No information available from the wild. In captivity: one female laid three 1 egg clutches; incubation 20-22 days.

Movements. No information available.

Status and Conservation. ENDANGERED. Mace-Lande: Critical. CITES II. Very poorly known, and no recent records from N Borneo; believed to have been eliminated throughout most of original range, e.g. no recent evidence from Muara Tehew in C Kalimantan, Balikpapan in E Kalimantan, or Paitan in Sabah. Reported recently from only two locations: one in W Kalimantan and another in E Kalimantan. Much lowland forest remains in Kalimantan, although if species is confined to alluvial forest then it is likely to have been eliminated from most of the major river systems in Kalimantan. Species is presumed always to have been very difficult to detect, possibly reflecting very low densities. Based on this, lost sites and habitat remaining, population is tentatively estimated to number no more than 1000 individuals. Not known from any protected area, but a thorough search of Gunung Palung Nature Reserve might prove fruitful. Extensive and continuous habitat loss and degradation are major problems facing the species. Surveys and research urgently required. Protected by Indonesian law.

Bibliography. van Balen & Holmes (1993), Collar & Andrew (1988), Davison (1986c), Denton (1978), Dutson (1990), Holmes (1989), Holmes & Burton (1987), Howman (1993), MacKinnon & Phillips (1993), McGowan (1992a), Smythies (1957, 1981), Wayre (1969), Wells (1985).

150. Palawan Peacock-pheasant

Polyplectron emphanum

French: Éperonnier napoléon German: Napoleonfasan Spanish: Espolonero de Palawan
Other common names: Napoleon's Peacock-pheasant

Taxonomy. *Polyplectron emphanum* Temminck, 1831, Sunda Islands or the Moluccas; error = Palawan.

Has occasionally been considered to form a superspecies with *P. malacense* and *P. schleiermacheri*. Monotypic.

Distribution. Palawan I. SW Philippines.



Descriptive notes. Male c. 50 cm (tail 24-25 cm), c. 436 g; female c. 40 cm (tail 16.5-17 cm), c. 322 g. Male is markedly different from all other members of genus; long, pointed crest, solid black underparts and shiny blue and green on mantle, upperwing-coverts and tertials characteristic; distinctive black and white face pattern. Female generally brown with scattered buff markings and ill defined, blackish subterminal patches on tail; face, lores and throat brownish white. Immature male similar to adult female, with black spots on wings and longer legs. Some captive-reared males have white eyebrow of varying prominence; distribution and frequency of this character in the wild is not known.

Habitat. Traditionally said to be restricted to coastal lowland forest, which has now mostly been logged. Several mountain sites within range are now known, from limits of disturbed forest up to c. 600 m.

Food and Feeding. No information available.

Breeding. No information from the wild. In captivity: clutch of 2 eggs; incubation 18-20 days, by female only; chicks have tawny brown down above, more buff-coloured below.

Movements. No information available.

Status and Conservation. VULNERABLE Mace-Lande: Endangered. CITES I. Little, if any, forest remains in level lowlands, certainly on E coast, and species now largely restricted to mountains.

Based on remaining habitat, population estimated at fewer than 10,000 individuals; must be declining, due to loss of habitat. In theory, all of Palawan is a Flora and Fauna Watershed Reserve; occurs in St Paul's National Park, although much of this park consists of limestone outcrops which carry unsuitable habitat; forest contained within penal colony at Iwahig, which does support species, would make an ideal protected area. Restricted range; occurs in Palawan Island Endemic Bird Area. Threatened by overexploitation for food and bird trade (birds recently reported in Puerto Princesa City); also loss and degradation of habitat. Surveys to S of island, around Brookes' Point and Quezon, may reveal that

species survives in good numbers. Present species has potential for use as a flagship in public awareness campaigns, tri-shaw painting, etc. Palawan Chapter of the Haribon Foundation, the major conservation non-government organization in the Philippines, is now active.

Bibliography Caleda (1987, 1993), Caleda *et al.* (1986), Collar & Andrew (1988), Davison (1985a, 1986a), Dickinson *et al.* (1991), DulPant (1971), Elleg (1973), Jeggo (1973, 1975), King (1975, 89), Lambert (1993), Lowe (1925), McGowan (1992a), McGowan *et al.* (1989), Roles (1990), Searle (1986, 1989), Spedan-Lewis (1939), Staper (1976), Teynton (1984).



PLATE 59

Family PHASIANIDAE (PHEASANTS AND PARTRIDGES)
SPECIES ACCOUNTS

PLATE 59

Genus *RHEINARDIA* Maingonnat, 1882

151. Crested Argus

Rheinardia ocellata

French: Argus ocellé

German: Perlenfasan

Spanish: Argos Perlado

Other common names: Rheinard's/Ocellated Argus, Crested Argus-pheasant; Malaysian Argus (*nigrescens*)

Taxonomy. *Argus ocellatus* Elliot, 1871, Hue, Vietnam.

Genus name has frequently been misspelt *Rheinartia*, and even in past *Rheinhardius*, *Rheinardius*, *Rheinartius* or *Rheinhardius*, amongst others. Two subspecies recognized.

Subspecies and Distribution.

R. o. ocellata (Elliot, 1871) - C Vietnam and E Laos.

R. v. nigrescens Rothschild, 1902 - mountains in C Peninsular Malaysia, within Taman Negara National Park.

Descriptive notes. Male 190-235 cm (tail 150-173 cm); female 74-75 cm (tail 35-43 cm). Male unmistakable; rectrices are the longest feathers in any bird. Female has distinctive head pattern and barring on upperparts. First-year male similar to adult male but tail shorter; attains adult plumage in 3rd year, but tail increases with each moult, until 5th or 6th. Male *nigrescens* darker than that of nominate *ocellata*, with more regular, whiter spots, and longer, whiter crest; browner bill.



Bibliography. Anderson (1993), Anon (1989c), Banks (1993), Chasen (1939), Collar & Andrew (1988), Davison (1977, 1978a, 1979a, 1979c, 1979d, 1980c, 1980d), Davison & Scriven (1987), Eames *et al.* (1992), Gibson-Hill (1949), Harrison (1972), Jahouille (1926, 1930), King (1978/79), Medway & Wells (1976), Nguyen Cu & Eames (1993), Robson *et al.* (1989, 1993a, 1993b), Roles (1990), Seth-Smith (1932), Siti Hawa Yatim (1993), Wells (1985, 1990), Wildash (1968).

French: Argus géant **German:** Argusfasan **Spanish:** Argos Real
Other common names: Great Argus-pheasant, Argus Pheasant

Taxonomy. *Plusianus Argus* Linnaeus, 1766. "Tartaria Chinesi"; error = Sumatra. Extinct form *bipunctatus*, possibly from Tioman I off Peninsular Malaysia, has alternatively been considered a race of present species or a distinct species; known only from a portion of a single male primary of uncertain origin (see page 436). Two subspecies recognized.

A. a. argus (Linnaeus, 1766) - Malay Peninsula S from c. 14° N; Sumatra.
A. a. gravi (Elliot, 1865) - Borneo.



Habitat. In Malaysia, inhabits tall logged forest and unlogged primary forest at many

sites, from sea-level up to maximum of 1000 m, although upper limit varies with location. Widespread in Indonesian part of range, occurring in lowland forest up to 500 m in Sumatra, and up to 1500 m in Kalimantan.

Food and Feeding. A wide variety of plant and invertebrate remains have been found in droppings; mainly fruits of *Palmae*, *Annonaceae* and *Leguminosae*, including climbing and understorey species, as well as those of canopy and emergent trees; termites encountered in only 1 out of 138 droppings, but ants common. Forages solitarily, walking slowly and peeking at leaf litter, or scratching at the litter surface in order to see what is underneath.

Breeding. Season not recorded; eggs found from early Mar to early Jul in Peninsular Malaysia, late Jul in Borneo. Solitary and territorial; males call and maintain dancing grounds, usually from Jan.

Movements. No information on seasonal movements. Monthly home ranges of two males were of 1.0-2.7 ha during Nov-Jan; core areas smaller.

Status and Conservation. Not globally threatened. Mace-Land: Vulnerable. CITES II field surveys in Peninsular Malaysia indicate density of 4 birds/km²; population is large and species widespread, but habitat rapidly becoming fragmented. Based on available habitat, total population estimated to number more than 100,000 individuals, but involved in a steep decline, especially in Sumatra, e.g. now very scarce in heavily disturbed forests of Way Kambas National Park. S. Sumatra: in Indonesia, reckoned to be secure only in reserves and well managed forests. Presence confirmed at 12 sites in Thailand, from plains up to c. 900 m; in Malaysia found in 17 protected areas of varying status, although some seem very small for a bird of such large size; assumed to be present in most protected areas in Indonesia. Species is very vocal, giving impression that it is very common in variety of forested habitats. However, rapid rate of forest clearance throughout range, leading to extreme fragmentation of once continuous lowland forest, suggests that severe decline in numbers may occur within next one or two generations of species. Does not appear to recolonize areas quickly. Assessment of upper altitude limit of species in Sumatra is very important, as this will determine whether species occurs in protected areas and above areas where logging is commercially viable. Protected by Indonesian law.

Holothuriforms Baker (1928), van Baaren & Holmes (1993), Banks (1935), Bruu (1975), Chazotte (1935), Coombs & Rutter (1946), Davidson (1979a, 1980a, 1981a, 1982b, 1983, 1984, 1987), Davison & Scriven (1987), Gibson-Hill (1949), Holmes (1989), Holmes & Burton (1987), Humphrey & Bain (1980), Johns (1986, 1989), Lekagul & Round (1991), MacKinnon & Phillips (1993), Mann (1987), van Marle & Vocus (1988), Medway & Wells (1976), Robinson (1951a, 1951b), Robinson & Kloss (1921, 1924), Roles (1990), Seth-Smith (1925), Sin Hwa Yatin (1933), Smythies (1957, 1981, 1986), Wells (1985, 1990).

French: Paon bleu German: Pfau Spanish: Pavo-real Común
Other common names: Common/Blue Peafowl, Indian Peacock

Taxonomy. *Pavo cristatus* Linnaeus, 1758, *Inde Orientale*, Sri Lanka. Monotypic.

Distribution. Pakistan (E of R Indus) through most of India (S from Himalayas) to Sri Lanka; may still occur in Bangladesh.

Introduced to many parts of the world, but usually remains semi-feral



Descriptive notes. Male 180–230 cm (tail 40–45 cm, train 140–160 cm), 4000–6000 g; wing-span 130–160 cm; female 90–100 cm (tail 32.5–37.5 cm), 2750–4000 g; wingspan 80–130 cm. Unmistakable, very distinctive crest. Female distinctive, with white belly. Second-year male resembles adult male, but train shorter and lacks ocelli; length of male's train increases with age, markedly so up to 4th year. Common captive form '*nigrispinus*' has scapulars and upperwing-coverts mostly black, labial

Habitat. Favoured habitat in N India appears to be open forest with ber (*Zizyphus*) undergrowth along streams; in S India, uses wide

range of habitats including secondary vegetation, orchards and other cultivation near villages, generally preferring moist and dry deciduous forests near streams; (occurs up to 2000 m.

Food and Feeding. Omnivorous. Food taken ranges from grain to green crops to insects, small reptiles, mammals and even small snakes; prefers berries, drupes (e.g. *Carissa*, *Lantana*, *Zizyphus*). **Nest and Wild life.** Cultivated fields and fallow land may be visited for feeding. Forages in small groups, harem in breeding season, segregated parties of females with young, and males, outside breeding season.

Breeding. Season varies across range but seems to be related to wet season; in most of S India and Sri Lanka, apparently Jan-Apr; in Tamil Nadu (S India), Oct-Dec; in Himalayan foothills, possibly Mar-Apr, but usually Jun. Polygamous. Nest usually concealed in scrub (*Lantana*, *Zizyphus*), but somewhat elevated in flood-prone areas. Usually 3-6 eggs (up to 8); incubation 28-30 days, by female only; chicks have dark brown and rufous down above, pale buff brown below.

Movements. No reliable information, but presumably sedentary, with small groups present in same area throughout year. Introduced population of Australia sedentary, but occasional movements of a few kilometres have been recorded.

Status and Conservation. Not globally threatened. Mace-Landse: Safe. No detailed information on status in India, as bird is considered so common that it is often overlooked as a rarity. In study, locally very common in Sri Lanka, e.g. in Yala, Bundala and Wilpattu Parks; in contrast, may have become extinct in Bangladesh, where was formerly common. The national bird of India. It is afforded protection throughout the country; in many areas it is protected because of its religious importance to both Hindus and Buddhists, who consider it sacred. Consequently, species lives in close proximity to human settlements, and is often found around villages and temples. As also minibus scrub, forest, semi-arid areas and cultivation, species is not considered in need of any conservation attention.

Bibliography Allen & Ripley (1980), Baker (1930), Chaudhry (1993), Gaston *et al.* (1981a, 1981b), Hannote *et al.* (1993a, 1993b), Harvey (1990), Hogg (1971), Hogg *et al.* (1983), Hogg & Ingleton (1989), Hogg *et al.* (1980), Lamb (1980), Lever (1987), Marchant & Higgins (1993), Manen (1951), Petrie *et al.* (1990), Phillips (1978), Rames *et al.* (1984), Ruffey *et al.* (1984), Roberts *et al.* (1984), Sauer *et al.* (1980), Sauer *et al.* (1986), Sutherland (1997), Sutherland & A. Vegetation Index, National Vegetation Survey, Panegy (1989), Zacharias & Gaston (1993).

154. Green Peafowl

Pavo muticus

French: Paon spicifère German: Ährenträgerpau Spanish: Pavo-real Cuelliverde
Other common names: Green-necked Peafowl, Green Peacock

Taxonomy. *Pavo muticus*. Linnaeus, 1766, Japan; error = Java.

Three subspecies recognized.

Subspecies and Distribution.

P. m. spicifer (Shaw & Nodder, 1804) - NE India and SE Bangladesh to NW Burma (possibly extinct).

P. m. imperator Delacour, 1949 - Burma S to Isthmus of Kra and E through Thailand to S China, Vietnam and Laos; patchy distribution.

P. m. muticus Linnaeus, 1758 - locally in Java; extinct in Peninsular Malaysia, and probably also in Thailand.



Descriptive notes. Male 180-250 cm (tail 40-47.5 cm, train 140-160 cm), 3850-5000 g; female 100-110 cm (tail 40-45 cm). Unmistakable. Female similar to male but shorter-legged, not so brightly coloured, and lacks long train of uppertail-coverts; dark chestnut-brown patch on lores; usually has spurs. Second-year male resembles adult male but has no ocelli in train. Races vary slightly in coloration; SE race *muticus* is brightest and greenest; NW race *spicifer* is duller, with upwing blacker and bluer, especially in male.

Habitat. In Java occurs in open woodland and at forest edge, but not inside rain forest, from sea-level up to 3000 m; also inhabits montane grassland above 2000 m. Found in riverine forest in Thailand.

Food and Feeding. Little known. Crops found to contain mainly termites, but also berries, grass seeds, peppers, flower petals, crickets, grasshoppers and small moths.

Breeding. In NE India, *spicifer* apparently breeds in Jan-Apr, but Jul-Sept also recorded; Apr-May in Bangladesh; in Java, *muticus* nests in Aug-Oct. Nests on ground, usually in sites that are well protected but with good visibility. Clutch of 3-6 eggs; incubation 26-28 days, by female only; downy chicks similar to those of *P. cristatus* but larger and greyer.

Movements. Believed to be fairly sedentary.

Status and Conservation. VULNERABLE. Mace-Lande: *muticus* endangered; *imperator* endangered; *spicifer* insufficient information. CITES II. Populations probably highly fragmented throughout range, and species may be more seriously threatened than available information indicates. Nominate *muticus* presumed extinct in Peninsular Malaysia (since 1960's) and probably also in Thailand. Now known only on Java, where has recently been found at 17 sites; a recent survey estimated population to number no more than 1000 birds; highly fragmented, and secure in only 3-4 areas; protected by Indonesian law, but some illegal trapping may continue; train feathers are used in traditional Javanese dances; this race present in Ujung Kulon National Park (761 km²), Baluran National Park (250 km²), Meru Betiri National Park (500 km²), Alas Purwo National Park (620 km²), Leuweng Sancang Nature Reserve (21 km²), Yang Nature Reserve (15 km²), Ijen Nature Reserve (25 km²) and proposed Cigong Nature Reserve (141 km²). In Thailand, *imperator* believed to be restricted to Huai Kha Khaeng Wildlife Sanctuary in W, while unconfirmed at three further sites: Thai population estimated to number c. 300 individuals. Total population of this race in thousands. Known from 10 sites in Tibet and a total of 9 contemporary sites are listed for Vietnam; occurs in several protected areas, in addition to Thailand's fully protected Hua Kha Khaeng (2575 km²); in Vietnam, found in Nam Bai Cat Tien National Park (350 km²), where up to 17 calling males were recently heard, just outside Bach Ma National Park (190 km²), and within Yok Don Reserve; in Laos, occurs in Xe Pian proposed protected area. Threatened by overexploitation for food and bird trade, habitat loss and degradation. Informed opinion suggests that *spicifer* is possibly extinct in both Bangladesh, where formerly a rare breeding resident in SE hill tract forest, and in India; no recent information from Burma; at best, this race is probably very rare.

Bibliography. Ali & Ripley (1980), Anderson (1993), Baker (1928, 1930), van Balen & Holmes (1993), van Balen *et al.* (1993), Chasen (1939), Cheng Tso-hin (1987), Collar & Andrew (1988), Deignan (1945), Eames *et al.* (1992), Gibson-Hill (1949), Harvey (1990), He Fen-qi *et al.* (1990), Hillgarth & Stewart-Cox (1986), Holmes (1989), Hoogerwerf (1949), Humphrey & Bain (1990), Indrawan (1992b), Indrawan & van Balen (1991), Inskipp & Inskipp

(1993b), King (1978/79), Lamba (1980), Lekagul & Round (1991), MacKinnon (1988), MacKinnon & Philipps (1993), Medway & Wells (1976), Meyer de Schauensee (1984), Nguyen Cu & Eames (1993), Robinson (1915a, 1915b), Robson *et al.* (1989, 1993a, 1993b), Round (1988), Sarker (1986), Siti Hawa Yatim (1993), Smythies (1986), Stewart-Cox & Quinell (1990), Zheng Guang-mei & Zhang Zheng-wang (1993).

Genus *AFROPAVO* Chapin, 1936

155. Congo Peafowl

Afropavo congensis

French: Paon du Congo German: Kongopfau Spanish: Pavo-real del Congo
Other common names: African Peafowl, Congo Peacock

Taxonomy. *Afropavo congensis* Chapin, 1936, Zaire, possibly upper Lukene River.

Only pheasant in Africa; affinities unclear, but probably closest to *Pavo*, although close relationships with Numididae and Cracidae also proposed. Monotypic.

Distribution. C & CE Zaire.



Descriptive notes. Male 64-70 cm (tail 23-26 cm), two birds 1361 and 1475 g; female 60-63 cm (tail 19.5-22.5 cm), two birds 1135 and 1154 g. Unmistakable. White bristles on crown of male sometimes very short; variable extent of naked red skin on neck. Female usually has spurs. First-year male duller, with back tinged brown; adult plumage attained in 2nd year.

Habitat. Inhabits primary lowland rain forest below 1200 m.

Food and Feeding. Believed to be omnivorous. Identified items include drupes of *Celtis ituriensis*, a common broad-leaved tree; also

aquatic insects and termites. Presence of termite larvae in gut contents suggests that birds may dig into termite mounds.

Breeding. Little reliable information from the wild, although it has been suggested that breeding may occur at any time, depending upon local rainfall conditions; 300 km S of equator, young birds found in Jan-Feb. In captivity often nests in trees, less than 1.5 m above the ground, laying eggs on concave platform rather than in true nest. Clutch usually of 2-3 eggs (up to 6); incubation 27-28 days; chicks have black and blackish brown down above, bright creamy yellow below, with cinnamon wings.

Movements. No information available.

Status and Conservation. INSUFFICIENTLY KNOWN. Mace-Lande: Insufficient information. Protected by law in Zaire since 1938. A very poorly known species, described less than 60 years ago; very difficult to detect and rarely seen in the wild; no records since an observation in 1982; unconfirmed sighting in Kahuzi-Biega National Park, Kivu, in early 1980's. Occurs in Maiko and Salonga National Parks and Ituri Forest, a recently declared national park, whence species was described. Threatened by logging and other pressures on forest resulting from expanding human population; known to have been snared for food and this practice apparently still continues where species persists; believed to be absent from areas within 25 km of each village and road by late 1950's and mid-1960's. Species is present and breeds in several collections, but successful pairing apparently difficult to achieve in captivity. An international studbook for species is held by Antwerp Zoo, Belgium; in Dec 1991 it recorded 64 males, 30 females and 3 unsexed young.

Bibliography. Appelman (1961), Assink (1991), van Bemmelen (1961), van den Bergh (1975), van Bockstaele (1988), de Boer & van Bockstaele (1981), Chapin (1936, 1938, 1937, 1942, 1948, 1953, 1954), Collar & Andrew (1988), Collar & Stuart (1985), Cordier (1949a, 1949b, 1959), Crandall (1949), Durrer & Villiger (1975), Ghigi (1949), Gysels & Rabaeu (1962), Hachisuka (1937), Hostie (1955a, 1955b), Hulsemans (1963), Jeggo (1972), Lippens & Wille (1976), Lovel (1976), Lowe (1938), Mackworth-Præd & Grant (1970), Prigogine (1953, 1956, 1971), Roles (1990), Schouteden (1937), Snow (1978), Taibel (1961), Urban *et al.* (1986), Verheyen (1956, 1962a, 1962b, 1965a, 1965b), Verschuren (1975, 1978).

Class AVES
Order GALLIFORMES
Suborder PHASIANI
Family NUMIDIDAE (GUINEAFOWL)



- Medium-sized, plump terrestrial birds, with small head, and extensive bare skin on head and neck; most species with crest or bony casque.
- 40-72 cm.



- Afrotropical Region.
- Wide variety of habitats, from dense rain forest to semi-desert.
- 4 genera, 6 species, 19 taxa.
- 1 species threatened; none extinct since 1600.

Systematics

The guineafowl have traditionally been considered a subfamily of an expanded version of Phasianidae (see page 434), but recent studies based on differences in DNA indicate that family treatment is appropriate for the group. According to DNA sequences the Numididae diverged from the Phasianidae lineage some 38 million years ago.

The family Numididae is endemic to Africa, and its closest relatives are apparently to be found in Phasianidae and Cracidae. It seems most likely that the guineafowl originated in the savanna zones of Asia, from a francolin-like phasianid, which probably colonized Africa some time around the middle to late Miocene. The changes in the distribution patterns of vegetation over geological time, determined by fluctuations in the climate and also by geological activity, influenced the taxonomic development of the ancestral guineafowl by causing a considerable degree of radiation. This, in turn, has led to the various representatives of the family occupying practically all of the biotopes found in Africa in the present day (see Habitat).

All four of the genera currently recognized within the guineafowl were clearly differentiated by the Pleistocene. Of the four, *Agelastes* is probably the most primitive. Its two species constitute a superspecies. The little known Black Guineafowl (*Agelastes niger*) was formerly awarded a separate genus, *Phasidus*, but in the early 1960's a detailed comparison of this species and the White-breasted Guineafowl (*A. meleagrides*) led to the conclusion that the two species were closely related, and should be united in a single genus.

Over the years, the Helmeted Guineafowl (*Numida meleagris*) has been subdivided into some 30 subspecies, but at present only nine are generally recognized, due to extensive intergradation. Two or sometimes three of these races have actually been considered separate species by some authors, and, while there is only limited support for this approach, there are three fairly clearly defined subgroups, with the nominate form occupying East Africa, the *galeata* group in West Africa, and the *mitrata* group in southern Africa. As in many similar cases, it is essentially a matter of personal preference as to whether these groups are treated as megasubspecies or allospecies, but zones of intergradation and the element of caution both argue in favour of the former.

The Plumed Guineafowl (*Guttera plumifera*) and the Crested Guineafowl (*Guttera pucherani*) form another super-

species. Some authors have preferred to recognize three species in the genus *Guttera*, dividing the Crested Guineafowl into two, with the promotion of the race *edouardi*, but once again extensive interbreeding, both in the wild and in captivity, has shown that they should be considered conspecific, although they have perhaps moved some little way towards speciation. About 15 subspecies have been described for the Crested Guineafowl, but currently only five of these are usually accepted.

While there is a certain amount of disagreement at the specific and subspecific levels, the four genera appear to be rather well defined, even if their relationships with one another are generally none too clear. Although the Helmeted Guineafowl has been known to hybridize with the Vulturine Guineafowl (*Acryllium vulturinum*) in captivity, the resultant young are sterile.

Morphological Aspects

Although the guineafowl constitute a distinctive group within the Galliformes, in structure and morphology they are generally rather similar to most other members of the order.

In the guineafowl, size appears to be related to the density of the vegetation in the habitats typically occupied by each species. Thus, the White-breasted, Black and Plumed Guineafowl, the species that frequent the areas with the thickest vegetation cover, are the smallest, with average wing lengths of about 20.5 cm for the first two species, and 22.5 cm in the last. The Crested Guineafowl, which inhabits areas with medium to high vegetation density, has a mean wing length of 24.5-26 cm, whereas the equivalent figure for the Helmeted Guineafowl of open or relatively open habitats is 25-28 cm. Finally, the largest species, the Vulturine Guineafowl, occupies open, arid ground and has a mean wing length of 29.5 cm.

Like other Galliformes, guineafowl are rather corpulent birds. The oval body is voluminous, exaggerating the bird's relatively small head. In all species, both the head and the neck are virtually featherless, and the bare skin is often beautifully coloured. The bare skin appears to play an important role in thermoregulation. It is also contorted into a whole series of adornments, including cartilaginous gape wattles, notably in the Plumed Guineafowl, folds of skin, for instance on the hind-neck of the Crested Guineafowl, warts on the cere, and cartilaginous bristles. As their vernacular names suggest, the

The presence of a bushy crest is one of the most characteristic morphological features of the genus *Guttera*, distinguishing its members from the other guineafowl. This genus is nowadays considered to comprise only two species, although until recently the normal version accepted three, as the widespread Crested Guineafowl was regularly split into two, with the recognition of a separate species for populations from Somalia south to central Tanzania. However, extensive morphological analysis has indicated that the two groups are best considered to form a single species with well marked subspecies.

[*Guttera pucherani edouardi*,
Umfulozi-Hluhluwe,
Natal, South Africa.
Photo: Trevor Barrett/
Bruce Coleman]



Helmeted Guineafowl has a bony "helmet", whereas the Plumed and Crested Guineafowl have bushy crests.

The long, incredibly slender neck of the Vulturine Guineafowl has almost certainly developed in order to enhance the bird's visibility over vegetation. The aspect is strikingly exaggerated by a series of long, elegant ornamental plumes which hang down over the breast and upper back.

All these adornments are amongst the most distinctive features of the different species or, in some cases, subspecies. The many races of the Helmeted Guineafowl are generally separated on the length and shape of the bony casque and of the gape wattles, and also on the presence or absence of cere bristles and filoplumes on the hindneck.

The bill is usually short and stout, with the upper mandible curved. It is particularly feeble in the Black Guineafowl, but, in contrast, appears really quite robust in the Vulturine Guineafowl, an effect again enhanced by the very thin neck.

The wings are rather small and rounded, clearly belonging to non-migratory birds. They are designed for short bursts of rapid flight, enabling the birds to make a quick escape when danger threatens, but are quite unsuitable for any form of sustained flight. This is again typical of galliform birds, as is their style of flight, involving an explosive take-off and a series of rapid, powerful wingbeats, followed by a glide down into cover. In line with the limited flying abilities of the guineafowl is their short tail, composed of 14-16 rectrices. The exception is the Vulturine Guineafowl, which has a relatively long tail, particularly the central tail feathers.

The tarsus is strong and generally fairly short, although once again the Vulturine Guineafowl is an exception, as it has rather long tarsi. The legs and feet, with three front toes, a single hind one and strong claws, are perfectly adapted to a terrestrial lifestyle, and reflects the fact that guineafowl mostly move about by walking.

Agelastes is the only genus in which birds sport spurs; these sprout from the tarsometatarsus as in the junglefowl (*Gallus*), not from the hypotarsal ridge as in most other Phasianidae. Males of *Agelastes* can have one or two spurs per leg, as also do a few females. The Vulturine Guineafowl commonly has a strange series of spur-like bumps along the rear face of the tarsus, the function of which is unknown. They are generally longer in males than in females, and vary individually both in

size and in number, with up to six recorded. *Agelastes* again differs from the other guineafowl genera by having the tarsal scales imbricated and in rows, as in the francolins. The other genera have the tarsi covered with pentagonal scales which are not lined up in rows.

Plumage is generally black or dark grey, although in all species, except the two members of the apparently primitive genus *Agelastes*, this is heavily spotted or vermiculated with white. There is sometimes a bluish tinge to the plumage, which is typically produced by the feather spotting being bluish white, rather than pure white, but there are fairly extensive areas of rich blue on the underparts of the Vulturine Guineafowl.

In all species, sexual dimorphism is limited merely to males being slightly larger than females, with no evident differences in plumage, which is in line with their tendency towards monogamy and also the participation of the male in the care of chicks (see page 440). During the breeding season, there is slight protuberance in the cloaca of males, at any rate in the Helmeted Guineafowl. However, there is no seasonal variation in plumage in any of the species.

Juvenile plumage tends to be rather similar to that of the adult, but generally drabber, often with a certain amount of brownish barring. However, the juvenile White-breasted Guineafowl, in addition to appearing generally duller than the adult, has the plumage pattern more or less inverted, since it is the belly that is white, not the upper breast or upper back, as in the adult. Most of the rest of the plumage is brownish black, but recent evidence indicates that the feathered head and neck almost certainly retain the patterned natal plumage until the bird moults into full adult plumage, as is the case in other guineafowl. The juvenile Black Guineafowl likewise shows a white belly.

There is very little information available about moult in the Numididae, but the Helmeted Guineafowl is known to undergo a complete post-breeding moult, with the flight-feathers apparently replaced in serially descendant order.

Habitat

The natural distribution of the guineafowl is restricted to sub-Saharan Africa, except for an isolated population of the



Helmeted Guineafowl in north-west Morocco. Between them, the different species occupy almost all available habitat types, from dense rain forest to arid steppe and semi-desert. They can be found from sea-level up to considerable altitudes, and the Helmeted Guineafowl even occurs at 3000 m.

The White-breasted, Black and Plumed Guineafowl occupy areas of tropical forest, essentially in the equatorial belt. They are generally restricted to undisturbed primary forest, although the Plumed also occurs in very mature secondary growth, while the White-breasted has been seen in selectively logged forest. The secretive nature of these species, together with the difficulty of their observation, means that even basic knowledge on habitat use remains rather limited.

In terms of habitat preference, the Crested Guineafowl can be considered somewhat intermediate, as it occurs in secondary and riparian forest and also along the forest edge. Much the most widespread member of the family, the ubiquitous Helmeted Guineafowl, in addition to its isolated Moroccan population, is found in almost any form of open country from the Sahel zone southwards. Its most typical habitats include relatively open savanna and mixed areas of savanna and bush, sometimes interspersed with cultivation, but it is also common in savanna woodland and along forest edge. Finally, the Vulturine Guineafowl is the species that occurs in the driest, most open habitats. It is typically found in rather arid zones, including mixed *Acacia* and *Commiphora* scrub and semi-desert, although it does also occur in woodland, thickets and even montane forest.

As can be seen, there is a certain amount of overlap between the habitat preferences of the different species, and in some cases more than one species can occur in a particular area. For instance both the Vulturine and White-breasted Guineafowl coincide with the Crested Guineafowl, although in very different habitats, separated almost by the full breadth of Africa. Nevertheless, in such cases of overlap, the different species do not tend to associate with one another, and only rarely do they mix.

The proximity of water-holes, or other sources of drinking water, seems to be a limiting factor in the distribution of guineafowl, with the exception of the Vulturine Guineafowl. This species has an exceptionally long caecum constituting over

23% of the entire length of the intestines, and this may permit it to regulate and limit water loss. Another requirement, for all species, is the presence of suitable trees for roosting in at night.

General Habits

All guineafowl species have highly terrestrial lifestyles. They fly only rather infrequently (see Morphological Aspects), normally either up onto their roosts at night, or in order to escape from predators, although in the latter case they often prefer to run off at great speed.

They are gregarious for most of the year, but when the breeding season approaches, the flocks disperse, so that only solitary individuals or pairs are seen, or the odd small group perhaps composed of non-breeders. The flocks are governed by a complex social structure, and research on the Helmeted Guineafowl has shown that, at least in this species, individuals can remain in the same flock over a period of several years.

Group size, outside the breeding season, varies quite considerably with the species, from the Black Guinea fowl, which normally forms groups of under ten individuals, to the Helmeted Guineafowl, which can gather in large flocks of over 200 birds, although this species usually occurs in much smaller flocks of 15-40 birds. The other species form flocks of intermediate size. There is no evidence to suggest that flocks have strictly defined territories, and the ranges of two neighbouring groups can overlap to some extent. Nevertheless, if, for example, two flocks of White-breasted Guineafowl meet, a fierce fight is likely to ensue. In contrast to this, several flocks of Helmeted Guineafowl can coincide at drinking sites, particularly good feeding areas, preferred dusting sites, or roosts, but these flocks will only defend their own particular territories on rare occasions, for instance where the population is exceptionally dense.

The various different species of guineafowl have to be constantly alert to the threat posed by their many potential predators (see Breeding), although there are different ways of dealing with such threats when they actually materialize. For instance, when a predator approaches a flock of White-breasted Guineafowl, they separate and scatter until the danger has passed, when they regroup with the help of a cheeping call. In contrast to this rather passive strategy, a flock of Helmeted Guineafowl will sometimes perform communal defence against a predator.

The evidence available suggests that all species roost in trees at night, on the whole communally. Helmeted Guineafowl sometimes use traditional roosting sites over such long periods that the accumulation of dried out droppings on the ground below has been known to build up to over 30 cm deep! However, similar persistence has not been recorded for the other species. Thus, the White-breasted Guineafowl, for example, seems simply to choose a roost-site every evening in whatever area it happens to be at the end of the day, without there being the slightest evidence to suggest that such sites may be reused. The Plumed Guineafowl uses a different tree each night, whereas the Crested Guineafowl may regularly roost in the same general area. On occasions when there may be no suitable roosting trees in the vicinity, the Helmeted Guineafowl, at least, will look for some sort of substitute, and this species has even been observed roosting on telegraph poles.

Despite their apparent reluctance to fly, guineafowl are highly mobile birds, and they tend to spend the greater part of the day roaming about their territories, searching for food. For instance, White-breasted Guineafowl spend at least 60% of the day feeding, 20% preening, 11% in trees or flying, and the rest of their time engaged in other assorted activities.

The daily routine of activities in the Helmeted Guineafowl, the best known species, is rather well established, varying little from one day to the next. The roosting site is occupied in the evening, and the birds remain there until dawn, when they set off for their drinking holes, already starting to feed on the way. Often, they move about in "Indian file", with all members of the flock following on behind the dominant male. During the hottest hours of the day, they give up feeding and concentrate on drinking, and sand- or dust-bathing, which frequently takes

Although, like most Galliformes, guineafowl are essentially terrestrial in most of their habits, they are well adapted to perching in trees, as demonstrated by this Plumed Guineafowl. Apparently, all members of this family regularly roost in fairly tall trees, normally in communal groups, both of which tendencies are very likely to help in reducing the risk of predation.

[*Guttera plumifera plumifera*.
Photo: Bruce Coleman]



Unlike the other members of the Numididae, the Vulturine Guineafowl presents a rather beautiful and even spectacular plumage. While it shares with most of the other species the generally blackish background colour with a plentiful spattering of small whitish dots, it shows an extensive area of rich blue on the underparts, as well as a small patch of dark chestnut down on the nape. However, it is the well developed black and white hackles that really stand out, and intensify the effect of the bird having a very long, slender neck; hackles are particularly long, thin neck feathers that are found most typically in the Galliformes. All guineafowl have the head and neck virtually devoid of feathering, which is thought to be an important feature in thermoregulation.

[*Acryllium vulturinum*,
Samburu National Park,
Kenya.
Photo: Günter Ziesler]



place at traditionally favoured sites. Then they pass on to the business of preening and oiling. After this, they head for a suitable area in the shade of some vegetation, where they rest, using various devices to reduce body temperature, including gular-fluttering, and also holding the wings away from the body and moving them from time to time for ventilation. As the heat of the day begins to ease off, the birds renew their activity and, having revisited the drinking hole, carry on feeding until it is time to return to the roost. Other activities that are performed somewhat less regularly include basking in the sun, seeking better shade and day-time roosting, as well as courtship display and even attempted copulation. In the feeding areas disputes sometimes break out, and these become increasingly common as the breeding season approaches.

Voice

Guineafowl are gregarious species that inhabit areas with vegetation that is thick enough to make visual contact between the different members of a flock rather difficult. They overcome this problem by means of a full vocal repertoire, which enables a sufficient degree of communication to meet their ordinary needs. For this reason, most activities have associated vocalizations, which can vary according to the different forms of behaviour involved.

When a White-breasted Guineafowl comes across a plentiful supply of food, it will often communicate its discovery to the rest of the flock by means of a call known as "food muster", summoning its companions to share the food. The contact calls and leaf scuffling typically used by this species can be heard about 30 metres away, although some of its other calls are louder. Apart from feeding and contact calls, other typical call types recorded in various species include, not surprisingly, those to signal alarm and others used in moments of aggression.

There are some differences between the sexes in vocalizations. For example, females of both the Vulturine and Helmeted Guineafowl have a "buck-wheat" call, which they most typically use during the breeding season, on occasions when they are separated from their partners.

Food and Feeding

The evidence available suggests that all guineafowl are omnivorous opportunists. The composition of their diet at any

particular moment is dictated by the local abundance of the various different food types, with the result that their daily wanderings in search of food can vary considerably, in terms of both time and direction.

Overall, the diet is very varied, and plant matter taken includes roots, bulbs, seeds, fruits, leaves and flowers. In some cases, the Crested and Helmeted Guineafowl, in particular, come into conflict with local farmers for their attacks on crops, although the overall effects of their presence in cultivation may not actually be detrimental (see Relationship with Man). Animal food consumed consists mainly of invertebrates, including a very wide array of insects, and also small molluscs, arachnids and millipedes; a few vertebrates are also eaten, for instance small frogs and toads. Birds also take in variable quantities of grit, which enable them to grind down their food more efficiently.

Some species, most notably the Helmeted Guineafowl, seem to prefer to feed on insects, when they are sufficiently abundant, and the crop of one individual examined, for example, was found to contain something in the region of 5100 harvester termites (*Hodotermes mossambicus*), which together weighed 243 grams. Nevertheless, in this same species it has been found that there is a tendency for considerable individual variation in feeding intensity, and crop contents can vary markedly between different members of a single flock.

In general, it is essential for guineafowl to have access to some source of drinking water, which they tend to visit regularly (see Habitat, General Habits). The exception, the Vulturine Guineafowl, of more arid zones, appears to be totally self-sufficient in this department, and it does not even seem to take the opportunity to drink when it comes across standing water, even at the height of the dry season.

All species feed almost exclusively on the ground, although the Crested Guineafowl has, on occasions, been seen feeding on fruits in trees. Similarly, the Vulturine Guineafowl occasionally climbs into low trees or bushes to feed on fruits, for example of *Salvadora persica* and several species of *Commiphora*. The Helmeted Guineafowl often strips the seeds off grass, or crops such as sorghum and millet.

Birds look for food as they walk along, pecking here and there, when they come across anything edible. They frequently use the feet to dig food out from under the ground, and with their strong claws they scrape away at the soil and the leaf litter. They may scrape with both of the feet alternately, or with only one foot, and all the while they peck at any food item that is unearthed. Only if the soil is soft enough will they also scrape about and even dig with the bill.

The curved bill enables the birds to reach and dig out underground bulbs and roots, which, in addition to forming a complementary source of nutrition, may be important in constituting an extra source of water, particularly during dry seasons.

The amount of food consumed by each individual seems to be inversely proportional to the distance covered during foraging. Thus, in areas with a rich supply of food birds tend to move slowly over fairly short distances, but where food is scarce they normally move much more quickly about over a much greater area.

As is the case of most birds and mammals in the tropics, feeding activity seems to be most intensive in the early morning, just after the birds have left their roosts, and again in the mid-afternoon and early evening. This is, of course, a consequence of the necessity to avoid the worst of the midday heat, when the birds invariably move into the shade to rest, and occupy themselves with plumage care and other comfort activities (see General Habits).

An interesting aspect of the feeding behaviour of the Numididae is that, as well as being gregarious, they also associate with other species of birds or mammals, in order to improve their rate of foraging success. For instance, the Crested Guineafowl sometimes follows arboreal monkeys, feeding on the remains of food that the monkeys drop onto the ground. While the same association with monkeys has not been recorded for the forest-dwelling White-breasted and Black Guineafowl, the former has been seen

With its rather plump build, the Helmeted Guineafowl is by no means an agile flier, and, although it can fly quite rapidly for short bursts, its flight tends to be rather heavy. Thus, it is hardly surprising that the species prefers to flee its predators by running away at top speed, before plunging into the shelter and safety afforded by thick vegetation.

[*Numida meleagris*
mitrata, Zambia.
Photo: S. Robinson/NHPA]

feeding on the remains of food possibly dropped on the ground by monkeys or chimpanzees (*Pan troglodytes*). The same species is known to associate with certain forest passerines that feed on the ground or in the lower canopy, for instance pittas (*Pitta*), turdids (*Alethe*, *Cercotrichas*) and bulbuls (*Bleda*); in such cases, it is thought that the guineafowl is probably looking for insects that may be disturbed or dropped by the birds.

The Helmeted Guineafowl regularly associates with a variety of other animal species. In many areas, it habitually feeds and drinks alongside baboons (*Papio cynocephalus*), and both species often try to steal bits of food from each other. Another, probably even commoner, association is with Swainson's Francolin (*Francolinus swainsonii*), whereas less frequently this species also joins Sacred Ibises (*Threskiornis aethiopicus*) and even introduced Common Mynas (*Acridotheres tristis*); mammals with which it sometimes associates include rhinoceros, antelope, lion and mongoose. Obviously, at water-holes, it occurs alongside many more species, but this can not really be considered a true association.

Breeding

Very little is known about the breeding habits of most members of the Numididae, and in some cases the size and colour of the eggs constitute virtually the only information available. Thus, details regarding courtship display, the roles of the sexes, the incubation period, overall levels of success, and so on, can only be interpolated tentatively from the best known species, the Helmeted Guineafowl.

The seasonality of breeding does not appear to follow particularly well set patterns, and the genera *Agelastes* and *Guttera* can breed at any time of year. Nevertheless, there do tend to be certain seasonal peaks which are apparently related to the rains. Thus, the White-breasted Guineafowl seems to prefer the end of the rains, whereas the Black Guineafowl probably breeds mostly in the driest months of the year. The other four species generally show a greater or lesser tendency to nest during the rains. An interesting case is that of the Crested Guineafowl, as its populations living in the vicinity of the equator, where there are two wet seasons in the year, nest all year round.

The first signs of breeding can be in the form of increased frequency and intensity of aggressive behaviour, in particular fights between rival males, and the splitting off from the flock of pairs that have been established. Male Helmeted Guineafowl can associate briefly with a series of various different females, each in its own turn, over the first four to six weeks. After this period, the pair stabilizes and then remains firm until the end of the breeding attempt. As a result of this system, the business of establishing and maintaining the pair-bond causes considerable expenditure of energy by the male, and this is reflected by a loss of weight amounting to about 11%. Although there is no clearly defined territory, at any rate in the case of the Helmeted Guineafowl, throughout this initial period males are perpetually chasing each other and fighting, and frequent communication, both vocal and visual, between partners is essential for the maintenance of the pair-bond.

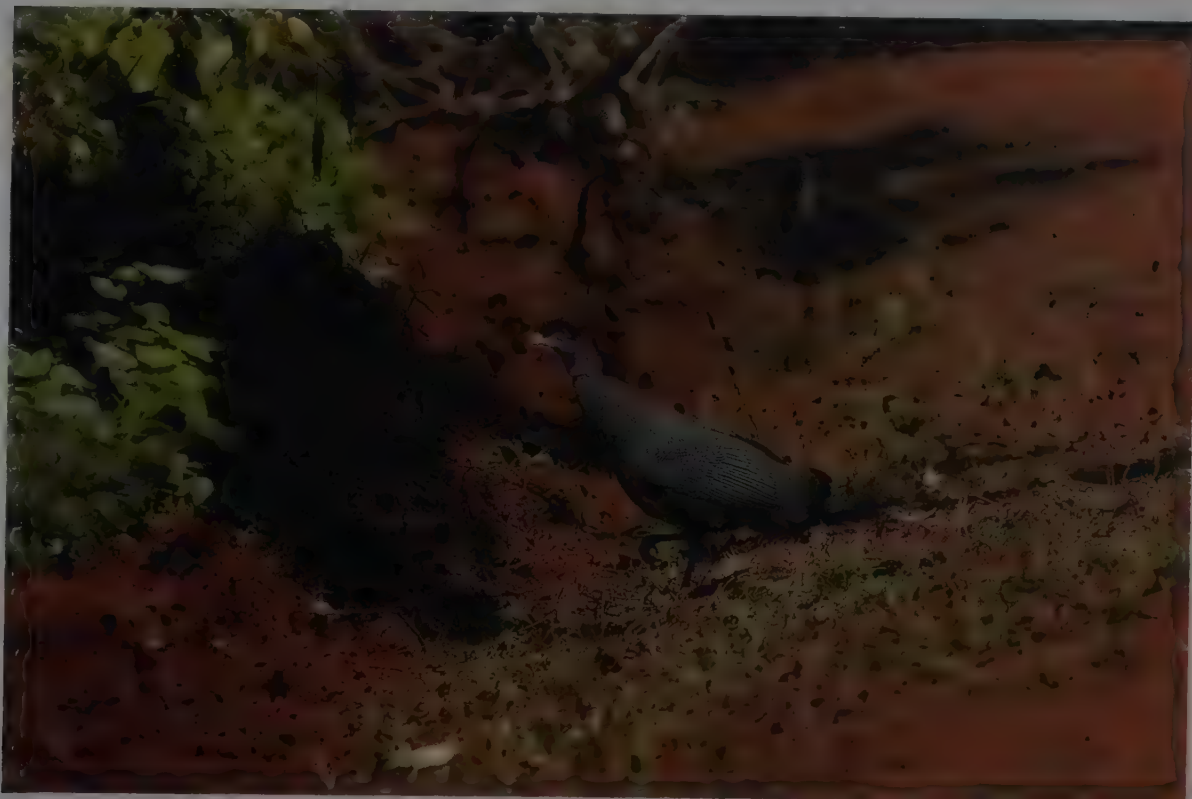
Courtship feeding is known to occur, at any rate in the Helmeted, Crested and Vulturine Guineafowl, and it is particularly ritualized in the last of these species. All three are monogamous, although males sometimes attempt to mate with other, unattended females. The Plumed Guineafowl is probably monogamous too, while individual males of the Black Guineafowl have been seen with two females.

No nest has ever been found for either the White-breasted or the Black Guineafowl, but they may well be similar to those of the other members of the family, which are very simple affairs. Essentially, the nest is a shallow depression in the soil, sometimes at the base of a tree or in long grass. It may be lined with a few dry leaves, perhaps a little grass, and sometimes the odd feather.

All species have pale eggs, ranging in colour from dirty white and cream to reddish or brownish, sometimes with a limited amount of spotting. The eggs are oval, with one end sharp and the other rounded. The shell is particularly thick, and its surface is pitted, with a dense covering of pores. It is said that the characteristics of the guineafowl egg would enable it to survive undamaged through a grass fire. Clutch size is normally of 4-19 eggs, but even larger clutches have been recorded, although these probably refer to cases of more than one female laying in the same nest. There is no record of any species ever laying more than a single clutch per season.

Descending from its roost early in the morning, the Crested Guineafowl dedicates most of the day to the search for food. Birds sometimes end up covering considerable distances daily in the process of foraging, although this, of course, depends largely on local food availability at the particular time. Once the midday heat sets in, birds tend to retire to some shady spot for repose, before proceeding forth again in the latter part of the afternoon.

[*Guttera pucherani*
pucherani, Kenya.
Photo: Roger Tidman/
FLPA]





Dust-bathing, or dusting, is one of the activities in which the Helmeted Guineafowl most commonly indulges. It serves to keep the plumage in prime condition, for instance by helping to remove parasites. Effective dusting often requires a certain amount of previous preparation, and a bird may spend some time breaking up the soil into a fine powder, so that it can more easily be dispersed throughout the plumage by means of jerks and wriggles of the body and wings.

[*Numida meleagris damarensis*, Etosha National Park, Namibia. Photo: Jeremy Woodhouse/DRK]

At any rate in the Helmeted Guineafowl, and probably also in the Crested Guineafowl, incubation is carried out entirely by the female, and during this period she hardly leaves the nest at all, while the male stands guard nearby, never letting his partner out of his sight. Incubation begins once the last egg has been laid, and lasts from 23 days in *Guttera* and *Acryllium* to 24–28 days in *Numida*.

Chicks, or keets, hatch synchronously, a common tendency in birds with nidifugous chicks, as it reduces the danger of predation. The precocial chicks are led away from the nest almost immediately, but, although they are capable of feeding themselves, they still require the guidance and protection of their parents for some time, and the male shares the tasks of chick-care with the female, at least in the Helmeted Guineafowl. In particular, during the first 12 days of the chicks' lives, the male takes on the burden of all the day-time brooding, while the female gradually recovers her strength and the weight she has lost during the formation and laying of the eggs, and also the entire process of incubation. At night, it is the female's turn to take on the entire responsibility of brooding the chicks, and the male goes off to roost with the rest of the flock. When the chicks are feeding, they are normally accompanied by both adults, but it is the female that acts as leader of the family group. At 15–20 days old, the chicks are already able to fly up onto roosts that are two metres off the ground.

When danger threatens, both adults take part in the defence of the chicks, the Helmeted Guineafowl often performing a frontal display with the wings spread and a growling threat, before launching into an attack. Guineafowl face a whole host of potential predators at the various different stages of breeding. For instance, various monkeys, genets and wild cats sometimes steal eggs, and the last-mentioned can even kill adults at the nest. Both the Black Crow (*Corvus capensis*) and the Lanner Falcon (*Falco biarmicus*) are known to take Helmeted Guineafowl chicks occasionally.

Once the breeding season draws to a close, the family group is merged into a much larger flock, consisting of other similar family groups and some non-breeding birds. Within this larger flock, the unity of the family group tends to persist, and the young birds remain in the company of their parents for at least two or three months more.

It has been calculated that, in an average population of Helmeted Guineafowl, during a normal breeding season, about 30% of the birds do not breed, although it is not known whether or not this percentage refers exclusively to immature birds. These non-breeders hang about in flocks in the habitual feeding areas, and later join up with the breeders when they return with their young. Although flocks are fairly stable, each individual does not necessarily return to the same flock that it belonged to before the breeding season.

Movements

All species of guineafowl are sedentary, and their movements are limited to the local ones that they perform daily, over variable circuits, in search of food and water. Although they are mainly terrestrial, they are surprisingly mobile on their feet, and the area in which they forage can vary quite considerably from one day to the next, when foraging success is low. Indeed, apart from the Helmeted Guineafowl, which is known to use traditional roosts (see General Habits), birds may start and end each day in quite different places.

The long, winding route followed daily by flocks of White-breasted Guineafowl, for example, takes them, on average, over an area of about 0.9 km². The speed at which the birds move about is directly related to foraging success, varying from 10 m/h to 203 m/h, with an average of 115 m/h. In the Helmeted Guineafowl, it appears that larger flocks tend to cover greater distances daily than smaller ones, although the relative proximity of roosting and drinking sites are also major factors. In this species, home range has been found to average about 8.8 km², although it is actually extremely variable depending on the habitat type.

Relationship with Man

The relationship of man with guineafowl goes way back into ancient times, mainly through the domestication of the Helmeted Guineafowl. Over the centuries, this species has probably been domesticated by several different peoples independently at different times.

Natural water-holes, and also those provided artificially for domestic livestock, are frequently used by Helmeted Guineafowl as habitual sources of drinking water. At such sites different flocks may come into contact with each other on a regular basis, and very large concentrations of birds may gather, although usually without any form of territorial dispute occurring. This species, the most gregarious of all the guineafowl, sometimes combined flocks of up to 200 birds or more.

[*Numida meleagris damarensis*, Savuti, Chobe National Park, Botswana. Photo: Richard Coomber/Planet Earth]



The earliest reference to guineafowl comes from murals of the Fifth Dynasty of Egypt in the Pyramid of Wenis at Saqqara, which date to about 2400 BC. The Phoenicians and Greeks are also known to have kept domesticated guineafowl, the latter from at least as early as about 400 BC. Only slightly later, in the fourth century BC, the Moroccan race *sabyi* of the Helmeted Guineafowl was considered a sacred bird on one of the islands of the Aegean. Subsequently, the Romans regularly kept birds of both this and the nominate race for food, and they carried both forms to all parts of their enormous empire. However, it seems that with the fall of the Roman Empire the species disappeared from Europe, and after this there was a long period in which it does not appear to feature in historical records, apart from an odd record of some captive birds in Athens in the tenth century AD. In the fifteenth and sixteenth centuries, the Portuguese explorers and navigators brought back individuals of the West African race *galeata* to Europe, and the species was regularly kept once again.

The repeated domestication of this species over many centuries has led to its presence practically all over the world, usually in domestic form, but in many cases with feral populations too. Such feral populations arose where a proportion of the domestic stock escaped and managed to establish more or less stable populations in the foreign habitat. This was the story, for example, on many islands in the West Indies, such as Cuba, whither the species was brought in 1508. Much of the importation of guineafowl to parts of Europe and especially America was effected by ships transporting slaves, and so many birds were imported that by the beginning of the eighteenth century feral populations had become established on most of the larger islands in the Caribbean. The species has also been introduced in several areas closer to home, for instance south-west Arabia, Madagascar, the west of Cape Province in South Africa, and several of Africa's outlying small islands. On the other side of the world, in Australia and New Zealand, there have been a multitude of instances over the years, at least since about the 1860's, of domestic birds escaping or being released, but they have invariably failed to become established, although in some areas birds live on in the vicinity of farms in a semi-domesticated state.

Guineafowl feathers have traditionally been highly prized as ornaments by the chiefs and witch doctors of some tribes.

In some areas, the birds were regarded as symbols of fertility, due to their profuse production of eggs, and these, in turn, were used in rites of initiation for young girls or newly-weds, or other, similar ceremonies.

Although guineafowl feathers were also used as adornments for women's hats in Europe, and the eggs came to form a part of a few local traditions in central Europe, man's main use for guineafowl has been as a source of food. Both the eggs and the flesh have been much appreciated by man probably since his first contact with them. The major consequence of this has been the breeding of guineafowl, invariably the Helmeted Guineafowl, on an industrial scale, and nowadays there are a great many farms dedicated to the production and commercialization of guineafowl. Proof of their wide culinary acceptance is supplied in the form of the surprisingly large number of recipes specifically for guineafowl that exist all round the world.

Within the natural ranges of the guineafowl, problems frequently arise due to a conflict of interests between man and the birds. Once again, it is mainly the Helmeted Guineafowl that is implicated, as this is the species that occupies the most similar habitat, and most readily occurs in cultivation. While farmers tend to consider the birds a plague, it seems that they should really be regarded as allies. While they will take a certain amount of some kinds of grain, the damage they cause to maize is virtually nil. At the same time they eat large quantities of destructive insects and also weeds, and thus collaborate significantly in the production of a healthy crop.

The Helmeted Guineafowl has recently been put to a new, rather revolutionary use in the USA, where it is now being employed in the control of infections spread by parasites, in this case those that produce Lyme disease. The parasites are spread by deer ticks, and until recently all attempts to control them had failed, but the release of the guineafowl in the infected area has proved very effective.

The generic name *Numida*, which also gives the name to the family, refers to the ancient North African state of Numidia, and illustrates the fact that from the point of view of the Romans the birds arrived from Numidia. The specific names *meleagris* of the Helmeted Guineafowl and *meleagrides* of the White-breasted Guineafowl are derived from the Greek hero Meleager, who hunted the great boar sent by Artemis to ravage

Calydon. Upon his death, his sisters were so grieved that they were turned into birds, the *meleagrids*, and their tears were transformed into white droplets all over their mourning dress. The birds that the Greeks referred to by this name were surely guineafowl, although it is equally sure that they were not White-breasted Guineafowl!

Status and Conservation

Of the six species of guineafowl, one is currently considered to be threatened, while the remaining species appear to be relatively secure. As a result of the recent Conservation Assessment and Management Plan (see page 472), which reviewed the status, threats and conservation requirements of all galliform species except the cracids, the situation of those species that are not considered to be threatened can now be viewed with a good deal more confidence.

Both the Helmeted and Vulturine Guineafowl are reckoned to have total populations numbering over a million individuals, and in the case of the former there are likely to be many millions. Populations of the very little known Black Guineafowl and also the Crested Guineafowl are both thought to be in the hundreds of thousands, and that of the Plumed Guineafowl in the tens of thousands. The one threatened species, the White-breasted Guineafowl, probably still numbers over 58,000 birds, but it is in constant decline.

The chief threats to the family as a whole seem to be habitat destruction and, in some cases, excessive hunting levels. Both of these factors are most serious in the cases of the forest species, and this is generally reflected in the population figures, as the species with the highest populations are those of open areas, while those of forest generally present much lower figures and are thought or known to be declining. Nevertheless, there are negative factors operating even on the Helmeted Guineafowl, the most serious of which is the increasing use of pesticides, which are likely to have adverse effects on the species in the long run. The Moroccan race *sabyi* of this species has declined drastically, for unknown reasons, and it may, in fact, already be extinct.

The main concern, however, must undoubtedly be for the prospects of the White-breasted Guineafowl, which is classified as Endangered, and is currently reckoned to be one of the most severely threatened species in the entire African continent.

The species is an inhabitant of one of the richest of African forests, the Upper Guinea Forest, which is famous for the large number of endemic forms it holds. This expanse of rain forest formerly spread over some 333,600 km², but it has suffered widespread devastation starting in the nineteenth century, and now occupies under 13% of the original area. Worst still, the habitat that remains is heavily fragmented into rather small pockets, which are spread over five different countries.

The other major problem that besets the species is excessive hunting pressure, in the form of both shooting and snaring. Such pressure has probably already led to some local extinctions and it threatens to bring about others in the not too distant future, especially in Liberia and Ghana. While many species are capable of withstanding a moderate level of hunting pressure, when this is combined with habitat loss and fragmentation, such large species can be systematically wiped out from each small pocket of forest until they disappear from whole areas. The situation is made all the worse by the ready availability of guns and cheap cartridges throughout Liberia, Ivory Coast and Ghana.

In Sierra Leone, the White-breasted Guineafowl occurs only in the Gola Forest, where it was first recorded in the late 1960's. There were very few subsequent records until an exhaustive avifaunal survey of this important site in 1988-1989 discovered that the species in fact occurs regularly throughout the forest. In the area around Mogbai, for example, it was recorded at densities of about 10-15 birds/km² in primary forest. Although it is also found in logged forest, it occurs at much lower densities of only 1-2 birds/km². The Gola Forest is protected with three reserves totalling some 748 km²; the limited hunting pressure that the species faces here suggests that this might be the healthiest population of all.

Due to many years of political unrest, the status of the species in Liberia is not well known, but as the forest is thought to be disappearing at a rate of about 5% per year, the situation is not encouraging. Indeed, the species is now considered rare.



Guineafowl nests are generally rather modest affairs, being simply a slight depression in the ground, sometimes under some vegetation cover, with or without a sparse lining of leaves, grass and perhaps feathers. The female Helmeted Guineafowl normally lays 6-12 eggs, which she herself incubates alone, although the male remains nearby. Incubation lasts 24-28 days, and does not start until the clutch is complete, thus favouring the synchronous hatching which is almost essential for those bird species that have nidifugous chicks.

[*Numida meleagris coronata*, South Africa.
Photo: J. J. Brooks/Aquila]

Guineafowl chicks leave the nest almost immediately after hatching. They are initially brooded and fed by the male, although in the Vulturine Guineafowl this may last only for the first few days, after which time the chicks are constantly accompanied by both parents. In this species, family groups tend to join up with other flocks of adults when the chicks are still in their first month. The chicks' flight-feathers are already well developed at ten days old, and at around eight weeks old the first of the characteristic blue underpart feathers begin to appear.

[*Acryllium vulturinum*,
Samburu National Park,
Kenya.
Photo: Günter Ziesler]



and to have disappeared from most of the country. It was thought to be extinct on Mount Nimba due to the opening up of the area for iron ore mining in the late 1950's and early 1960's, but it has recently been resighted there. There are also some fairly recent records from the Sapo National Park and the Grebo National Forest, but heavy hunting pressure may have eliminated the species from the latter.

In Ivory Coast, the species has not been seen anywhere outside the Taï National Park since the 1970's; like the Gola

Forest, the Taï can be considered one of the most important areas of forest in the whole of Africa, with a total area of 4060 km², including a buffer zone of 660 km². Recent surveys have revealed that the species is uncommon to rare, with an overall density of 16 birds/km², which has been extrapolated to give an estimated total population for this park of some 30,000-40,000 birds. While some hunting seems to occur, the scale of this is not yet known, although there is reason to believe that it may be fairly limited. Apart from survey work and proposals for protection, one of the major steps towards the conservation of the species involves the first significant studies of its biology and ecology, studies which were carried out in the Taï Forest from 1989 to 1991.

The remaining countries that fall within the White-breasted Guineafowl's range are Guinea and Ghana, but the population that was thought to occur in the south of the former has probably now been extirpated. In Ghana, too, the species was assumed extinct for some years, as there were no records at all between 1963 and 1985, but several recent records in different areas, including some parks, have proved that this is not the case. Nevertheless, the rampant deforestation and hunting that pervade these areas suggest that the outlook for the species in Ghana remains bleak.

The key to the survival of the White-breasted Guineafowl seems to be very clear. If large tracts of primary forest can be preserved relatively undisturbed, with hunting pressure reduced to a minimum, the species is unlikely to disappear. For this reason, every effort should be made to promote the strict protection of the Gola and Taï Forests, while the same could also be said for all other areas where the species is still known to occur in Liberia and Ghana. The preservation of these essential sites would assure the future of this and many other threatened species.

General Bibliography

Cracraft (1981), Crowe (1978a, 1978b, 1985), Crowe & Snow (1978), Ghigi (1936), Hastings Belshaw (1985), Mainardi (1963), Peters (1934), Raethel (1988), Rutgers & Norris (1970), Sibley & Ahlquist (1990), Sibley & Monroe (1990), Sibley *et al.* (1988), Stock & Bunch (1982), Urban *et al.* (1986), Verheyen (1956).



The White-breasted Guineafowl is currently considered to be one of the most threatened species in all Africa. It has a limited range in the Upper Guinea Forest of West Africa, where it is more or less restricted to primary rain forest, a habitat type that is rapidly being degraded or, in places, completely destroyed. Although the species is found in some protected areas, for long-term survival it will require a more extensive network of such parks, and more efficient protection, not only from the effects of habitat loss, but also from the considerable hunting pressure it faces.

[*Agelastes meleagrides*,
Taï National Park,
Ivory Coast.
Photo: I. S. Francis]

PLATE 60



3



4



5



Genus *AGELASTES* Bonaparte, 1850

1. White-breasted Guineafowl

Agelastes meleagrides

French: Pintade à poitrine blanche German: Weißbrust-Perlhuhn Spanish: Pintada Pechiblanca

Taxonomy. *Agelastes meleagrides* Bonaparte, 1850, no locality = Ghana.

Forms superspecies with *A. niger*. Monotypic.

Distribution. SE Sierra Leone through Liberia and Ivory Coast to W Ghana.



Descriptive notes. c. 40-45 cm; c. 815 g (in captivity). Head and upper neck bare; lower neck, breast and upper back pure white; rest of plumage black; 1-2 spurs. Female similar to male, but averages smaller. Juvenile generally dull brownish black, with some reddish brown feathers on wing and body; apparently retains juvenile down on head and neck, dark sepia with pale ochre stripes; lacks white collar, but belly pure white; spurless.

Habitat. Dense primary rain forest, with apparent preference for drier areas; also found in nearby patches of selectively logged forest, especially older regrowth, but presence of primary forest seems essential. Normally roosts in thin, shrubby trees in understorey of forest.

Food and Feeding. Mostly invertebrates, including termites, ants, crickets, millipedes, worms, beetle larvae (Chrysomelidae), spiders and small molluscs; also takes berries and seeds fallen off forest trees. Forages on ground, walking slowly along and stopping frequently to scratch in amongst soil and leaf litter with feet. When one bird finds abundant source of food, will often summon other flock members to join in.

Breeding. Oct-May, perhaps peaking at end of wet season Nov-Jan, but may breed throughout year. Nest undescribed. Clutch c. 12 eggs. Eggs reddish buff with white pores; 45 x 35 mm. Chicks have down greyish brown patterned with pale ochre, and dark sepia on head and neck. No further information available.

Movements. Sedentary. Short local movements over c. 0.9 km².

Status and Conservation. ENDANGERED. Mace-Landé: Vulnerable. One of most severely threatened species in Africa. Total population estimated at over 58,000 birds; undergoing major decline due to destruction and fragmentation of habitat, and also excessive hunting pressure. Probably occurred in S Guinea in past. In Sierra Leone, restricted to Gola Forest, where protected in three sizeable reserves; major survey in late 1980's found density of 10-15 birds/km² in primary forest; hunting pressure possibly lower here than anywhere else in species' range, partly because a cartridge costs more than the value of the bird, so hunters tend to concentrate on larger game; trapping also considered to be relatively unimportant. Has disappeared from most of Liberia; thought to have been eradicated on Mt Nimba in late 1950's and early 1960's, due to opening up of area for mining, but recently rediscovered; fairly recent records from Sapo National Park and Grebo National Forest, but may now have been eliminated from latter by intense hunting. In Ivory Coast, restricted to Taï National Park, where recent research and surveys carried out; density of 16 birds/km² giving possible overall population of 30,000-40,000 birds for park. In Ghana, was thought to be extinct, with no records after 1963, but several recent sightings: in 1985 at Bia; in 1988 in Mini-Suhien National Park; and in 1989 in both Boia-Tano and Tano-Anwia Forest Reserves, and further S at Enchi; nevertheless, deforestation and hunting particularly excessive throughout this zone, and future of species in Ghana remains precarious. Highly susceptible to pressure of hunting and deforestation; disappears from logged areas, or at best occurs at much lower densities, e.g. 2 birds/km² in Gola Forest; presence in secondary growth may require close proximity of undisturbed primary forest. Further surveys urgently required for more precise appraisal of total population size and requirements; other main recommendation is effective protection of maximum number of areas where species still occurs; campaigns to inform public and terminate hunting also highly desirable. CITES III in Ghana.

Bibliography. Allport (1991), Allport *et al.* (1989), Bannerman (1953), Bechinger (1964), Collar & Andrew (1988), Collar & Stuart (1985, 1988b), Colston & Curry-Lindahl (1986), Davies (1987), Dutton & Branscombe (1990), Francis *et al.* (1992), Garshore (1989), Gatter *et al.* (1988), Grimes (1987), Hall (1961), Mackworth-Praed & Grant (1970), McGowan, Carroll & Ellis-Joseph (1994), Taylor (1988), Thiollay (1985e), Urban *et al.* (1986).

2. Black Guineafowl

Agelastes niger

French: Pintade noire German: Schwarzperlhuhn Spanish: Pintada Negra

Taxonomy. *Phasidus niger* Cassin, 1857, Cape Lopez, Gabon.

Sometimes retained in monotypic genus *Phasidus*. Forms superspecies with *A. meleagrides*. Monotypic.

Distribution. SE Nigeria to N Angola (Cabinda), and eastwards N of R Congo to extreme NE Zaire. **Descriptive notes.** c. 40-43 cm; c. 700 g. Head bare, with short crest of black down; rest of plumage black, but centre of belly browner; 1-2 spurs. Female similar to male, but averages smaller. Juvenile has belly white; spurless.

Habitat. Dense primary rain forest, with possible preference for dense undergrowth; also occurs at forest edge in Gabon, and in abandoned cultivation in forest clearing in N Angola, but in Cameroon apparently restricted to forest interior.

Food and Feeding. Basically insects, with beetles, ants and termites recorded; other invertebrates such as millipedes and small frogs. Plant matter includes hard seeds, green leaves and fruits (e.g. of palm trees). Forages on ground, scratching with feet.

Breeding. In NE Zaire, breeds in almost any month, but mainly during drier months Dec-Feb; elsewhere little known, and birds captured Dec-Feb in Congo, and Sept in Angola were not in breeding condition. Nest undescribed, eggs pale reddish brown, sometimes tinged yellow or violet; c. 42 x 34 mm. Chicks mainly dark rufous and black above.



would be highly desirable, with a view to establishing suitable protected areas within its range; effective control of hunting seems necessary, at any rate in parts of range, in combination with campaigns of environmental education.

Bibliography. Ash (1990), Bannerman (1953), Chapin (1932), Lippens & Wille (1976), Mackworth-Praed & Grant (1970), McGowan, Carroll & Ellis-Joseph (1994), Pinto (1983), Rodewald *et al.* (1994), Surgeant (1993), Thiollay (1985e), Urban *et al.* (1986).

Genus *NUMIDA* Linnaeus, 1766

3. Helmeted Guineafowl

Numida meleagris

French: Pintade de Numidie German: Helmpferlhuhn Spanish: Pintada Común
Other common names: West African/Grey-breasted Guineafowl (*galeata*); Tufted Guineafowl (*mitrata*); Reichenow's Guineafowl (*reichenowi*)

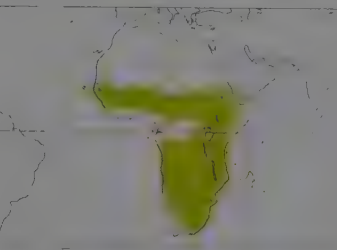
Taxonomy. *Phasianus meleagris* Linnaeus, 1758, upper Nile, Nubia, Sudan.

Races *galeata* and *mitrata* sometimes considered separate species; also, though less frequently, *reichenowi*. Over 30 races described; traditional races *marchei*, *calleswaerti* and *blancum* now included in *galeata*; major, *metary*, *omochrysis*, *macrocristus*, *neumannii*, *torrensii*, *intermedia* and *uhenensis* included in *meleagris*; *ansorgei* included in *reichenowi*; *maxima*, *frommi*, *rikwae* and *bodalyae* included in *marungensis*; *papillata* included in *damarensis*; and *transvaalensis* and *limpopoensis* included in *cornuta*. Nine subspecies currently recognized.

Subspecies and Distribution.

N. m. subyi Hartert, 1919 - NW Morocco, between R Oum er Rhia and R Sebou.
N. m. galeata Pallas, 1767 - W Africa, E to S Chad and S to C Zaire and N Angola.
N. m. meleagris (Linnaeus, 1758) - E Chad E to Ethiopia, and S to N Zaire, Uganda and N Kenya.
N. m. somaliensis Neumann, 1899 - NE Ethiopia and Somalia.
N. m. reichenowi Ogilvie-Grant, 1894 - Kenya and C Tanzania.
N. m. mitrata Pallas, 1767 - W & E Tanzania S to E Mozambique, and W through Zambia and Zimbabwe to S Angola and N Botswana; Zanzibar and Tumbatu I.
N. m. marungensis Schadow, 1884 - S Congo Basin S to W Angola, and E in Zambezi Basin to Luangwa Valley, Zambia.
N. m. damarensis Roberts, 1917 - S Angola to Botswana and Namibia.
N. m. cornuta Gurney, 1868 - E South Africa.

Introduced to many parts of world, e.g. Cape Verde Is, SW Arabia, Madagascar and West Indies.



Descriptive notes. 53-63 cm; 1150-1600 g. Head and neck mostly featherless, with bare skin blue to bluish white; characteristic horn-coloured bony casque and variety of mainly red facial appendages, with black filoplumes on hindneck; plumage mainly blackish grey, with white spots and vermiculations. Female similar to male, but averages smaller. Juvenile plumage generally dull dark brown with feathers tipped reddish cream; casque, wattles etc. smaller; retains original down on head almost until adult plumage assumed. Races separated mainly on configuration of appendages on head and neck, including: density and

extent of filoplumes on hindneck; form and colour of cere; shape, size and colour of wattles; presence and form of cere bristles; size and shape of casque; and also breast colour.

Habitat. Wide variety of habitats mainly in open country, ranging from forest edge through savanna woodland to thorn-scrub, steppe and subdesert; particularly common in savanna with areas of cultivation interspersed. Local distribution limited by availability of drinking water, and suitable roosting sites, normally in trees or bushes. Occurs from sea-level up to above 3000 m. Often found in large numbers at water-holes.

Food and Feeding. Omnivorous. Plant food generally more important overall by volume, especially seeds, but also tubers, bulbs, roots, berries, flowers, leaves in cultivation, especially on fallen grain, causing some local conflict with farmers (see page 561). Invertebrates only consume average 12% of annual total by volume, but are preferred food when sufficiently abundant; mainly insects, particularly grasshoppers and termites, but wide variety recorded; also takes snails, ticks, worms, millipedes, etc. Forages on ground scratching with feet; also strips seeds from grass heads; ticks may be picked off backs of warthogs (*Phacochoerus africanus*).

Breeding. Season almost always in or just after rains, mainly Nov-Jan in S Africa, mostly May-Jul in W Africa, Mar-May in Morocco, Monogamous, but pair-bond not maintained during breeding season; in early part of season, male can attempt to mate with several different females. Nest is simple scrape in ground, lined with grass and feathers; usually situated in areas of long grass, and hidden under bush or tussock of grass, or in dense cover. Normally 8-12 eggs, incubated approx 20 laid on successive days; nests with large numbers of eggs (20-50) are probably always result of

laying by more than one female; replacement laying not recorded. Eggs usually yellowish to pale brown with darker speckling, but sometimes almost white; 44-58 x 36-42 mm. Incubation, starting when clutch complete, 24-28 days, by female only; hatching synchronous; chicks have down cinnamon-buff with dark streaks; can fly weakly at 14 days; fledging c. 4 weeks; chicks reach full adult weight by 30 weeks old; family groups join larger flocks when chicks 1-3 months old. Chick mortality generally rather high. Probably only one brood.

Movements. Sedentary. Home range of flock varies in size with habitat: averages smaller (0.8-1.8 km²) in primary woodland, larger (7.6-21.2 km²) in upland secondary woodland in Nigeria. Extent of local movements seems to be closely linked with proximity of roosting sites to sources of drinking water.

Status and Conservation. Not globally threatened. Mace-Lande: Safe; race *sabyi* possibly endangered. Total population probably numbers well over 1,000,000 birds; widespread and locally abundant; generally stable. Most races common to abundant, but some are severely affected locally by hunting and egg-collecting. However, because of wide habitat tolerance, species remains highly resilient; nevertheless, degradation of habitat, especially through use of pesticides, is major potential threat. Race *sabyi* may already be extinct; thought to number maximum 100 birds. Has undergone drastic decline for unknown causes; recently, only three records from 1970's, and no recent evidence of breeding. Formerly common in Forest of Mamou, whence no recent records; was also common on plateaux to S and SE, but now apparently confined to small area of Middle Atlas, if survives at all; thorough study needed, to establish current situation, and identify causes of decline, with a view to attempting to ensure survival of subspecies.

Bibliography. Angus & Wilson (1964), Ayeni (1979, 1980, 1981, 1983, 1984), Ayeni *et al.* (1983), Bannerman (1953), Benson (1960a), Berry & Crowe (1985), Brown & Britton (1980), Cramp & Simmons (1980), Crowe (1978c, 1979), Duffly (1992), Elbin *et al.* (1986), Farkas (1965), Ginn *et al.* (1989), Gratton (1971), Langrand (1990), Lever (1987), Mackworth-Praed & Grant (1957-1973), Maclean (1993), Maier (1982), Maier *et al.* (1983), Marx & Stoltz (1988), McGowan, Carroll & Ellis-Joseph (1994), Mentis *et al.* (1975), van Niekerk (1979, 1980, 1985), Penzhorn *et al.* (1991), Pinto (1983), Rutgers & Norris (1970), Siegfried (1965a, 1965b, 1966), Skeld (1962), Steyn & Tredgold (1967), Urban *et al.* (1986), Weise & Baxton (1967), Wolff (1976).

Genus *GUTTERA* Wagler, 1832

4. Plumed Guineafowl

Guttera plumifera

French: Pintade plumifère German: Schlichthauben-Perlhuhn Spanish: Pintada Plumifera

Taxonomy. *Numida plumifera* Cassin, 1857, Cape Lopez, Gabon.

Forms superspecies with *G. pucherani*. Races intergrade in NE Congo. Two subspecies recognized.

Subspecies and Distribution. *G. p. plumifera* (Cassin, 1857) - S Cameroon, N Congo and CN & S Central African Republic, S through N & W Gabon to N Angola (Cabinda).

G. p. schubotzi Reichenow, 1912 - N Zaïre E to W Rift Valley, S into forests W of L Tanganyika.



Descriptive notes. c. 45-51 cm. Bare skin of head and neck grey, including gape wattles and small occipital fold of skin; long black crest; plumage black spotted white, but lacking vermiculations; primaries chestnut, outer margin of outermost secondaries white. Female similar to male, but averages smaller. Juvenile has black down on head and neck; shorter crest; upperparts grey barred blackish; breast dusky with spotted and barred whitish. Race *schubotzi* has patches of orange skin in front of ear and on hindneck.

Habitat. Mainly restricted to primary forest; also occurs in very mature secondary growth.

Food and Feeding. Omnivorous: plant matter, such as seeds, roots, shoots, fruits and leaves; animals, especially invertebrates, including snails, slugs, millipedes, spiders and wide variety of insects, e.g. cockroaches, beetles, grasshoppers, crickets, Hemiptera, termites and ants. Forages on ground, scratching in soil and leaf litter with feet.

Breeding. Laying dates variable, and probably not seasonal, although drier months apparently avoided. Probably monogamous. Nest is small scrape on forest floor lined with dry leaves. Two clutches of 9 and 10 eggs. Eggs pale buff with many darkened pores; 47.5-53.3 x 37-39.9 mm. Incubation c. 23 days; chicks have down mainly buffy with dark longitudinal stripes.

Movements. Sedentary.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Total population may number 10,000-100,000 birds. Generally appears to be rather uncommon, and probably unevenly distributed within its range. Apparently in decline as consequence of habitat loss and hunting pressure. Research needed on ecology of species, in order to establish requirements, and ultimately enable effective protection of sufficient area of prime habitat.

Bibliography. Bannerman (1953), Carroll (1988), Chapin (1932), Green, A.A. (1984), Lippens & Wille (1976), Louette (1981), Mackworth-Praed & Grant (1970), McGowan, Carroll & Ellis-Joseph (1994), Pinto (1983), Sargeant (1993), Thiollay (1985c), Urban *et al.* (1986).

5. Crested Guineafowl

Guttera pucherani

French: Pintade huppée German: Kriuselhauben-Perlhuhn Spanish: Pintada Montaña
(Other common names: Kenya Crested Guineafowl (*pucherani*); Crested Guineafowl (*edouardi*))

Taxonomy. *Numida pucherani* Hartlaub, 1860, Zanzibar.

Forms superspecies with *G. plumifera*. Formerly considered to constitute two separate species, with recognition of *G. edouardi* (Crested Guineafowl), which included all of present races, except nominate *pucherani* (Kenya Crested Guineafowl), but thorough analysis of morphological characters concluded that the two were conspecific. Several other races described: *sethsmithi*, *schoutedeni*, *pallasi*, *chapini* and *kathleenae* now included in *verreauxi*; *lividicollis* and *symensi* included in *edouardi*, and *graini* included in *pucherani*. Five subspecies normally recognized.

Subspecies and Distribution.

G. p. verreauxi (Elliot, 1870) - Guinea-Bissau E to NW Cameroon; E Congo E through Zaïre to W Kenya, and S to W & E Angola and W Zambia.

G. p. sclateri Reichenow, 1898 - NW Cameroon.

G. p. pucherani (Hartlaub, 1860) - SW Somalia W to EC Kenya, and S to C Tanzania, Zanzibar and Tumbatu I.

G. p. barbata Ghigi, 1905 - SE Tanzania S to E Mozambique and W to Malawi.

G. p. edouardi (Hartlaub, 1867) - E Zambia; Mozambique to NE South Africa (S to CE Natal).



Descriptive notes. 46-56 cm; male 721-1573 g. Bare skin of head and neck greyish blue, with patches of red or pale yellow on throat and around eye; iris red; well developed occipital skin fold; fairly long, bushy black crest; plumage black, spotted bluish white; primaries brown, outer margin of outermost secondaries white. Female similar to male, but averages smaller. Juvenile generally duller, finely barred black and white; bare skin much drabber. Races differ in colour of bare skin, especially in presence and extent of red on throat; also iris colour, brown in *verreauxi*; colour and form of occipital fold; shape and extent of crest; and presence and extent of black collar. Only nominate race has red skin round eye; *edouardi* lacks any red, and has whitish patch covering occipital fold; *sclateri* has crest short at front.

Habitat. Forest edge, secondary forest and gallery forest; also in forest-savanna mosaic. In NW Zambia, found in dense stands of pure *Cryptosepulum* woodland. Sometimes enters primary forest, where may coincide with *A. meleagrides*. Recorded up to 2200 m in Itombwe Mts, E Zaïre.

Food and Feeding. Omnivorous. Plant food includes seeds, fruits and berries of Rubiaceae, Amaranthaceae, Compositae, Malvaceae and Leguminosae; also shoots, stems, green leaves, bulbs and roots, e.g. of manioc. Animal food mainly invertebrates, including variety of insects (larval and adult beetles, grasshoppers, Hemiptera, flies, ants and termites), millepedes, spiders and small snails. Mainly forages on ground scratching in leaf litter and debris with feet, but has been seen eating fruit up trees; also follows troops of monkeys, feeding on fruit that they drop.

Breeding. Laying mainly during rains, but throughout year in equatorial zone; Nov-Feb in S Africa. Monogamous. Nest is scrape on ground with sparse lining, mainly of dead leaves and grass; usually well hidden, beside log or tree roots or under a bush. Normally 4-5 eggs, occasionally up to 7; clutches of 10-14 recorded in South Africa, but almost certainly with 2 females laying in same nest. Eggs deep buff to pinkish or white; 50-55 x 37.8-43.5 mm. Incubation c. 23 days, probably by female alone; chicks have down mainly buffy with dark longitudinal stripes; can fly at c. 12 days; fledging c. 30 days. Breeding success thought to be poor in general, as very few obviously immature birds seen in flocks during dry seasons.

Movements. Sedentary. Covers considerable distances during daily wanderings.

Status and Conservation. Not globally threatened. Mace-Lande: Safe. Total population may number over 100,000 birds. Shy habits and difficulty of observation may suggest species is less common and widespread than it really is; locally common in E South Africa. Population apparently stable overall, but may be affected locally by habitat loss and hunting. In Nigeria, increasing urbanization and also agricultural expansion, with planting of cocoa, oil palms, rubber, etc.; this, in conjunction with excessive and uncontrolled hunting, has led to certain reduction in range of species.

Bibliography. Ayeni (1979), Bannerman (1953), Berry (1972), Brooke (1984), Brown & Britton (1980), Crowe (1979), Ginn *et al.* (1989), Grimes (1987), Hill (1974), Lippens & Wille (1976), Louette (1981), Mackworth-Praed & Grant (1957-1973), Maclean (1993), McGowan, Carroll & Ellis-Joseph (1994), Pakenham (1979), Pinto (1983), Rutgers & Norris (1970), Thiollay (1985c), Urban *et al.* (1986), Wilson (1965).

Genus *ACRYLLIUM* G. R. Gray, 1840

6. Vulturine Guineafowl

Acryllium vulturinum

French: Pintade vulturine German: Geierperlhuhn Spanish: Pintada Vulturina

Taxonomy. *Numida vulturina* Hardwicke, 1834, West Africa; error = Tsavo, Kenya.

Monotypic.

Distribution. S Ethiopia, NW & SW Somalia and arid parts of N & E Kenya, S to R Pangani (NE Tanzania).



Descriptive notes. c. 60-72 cm; 1026-1645 g. Largest guinea-fowl. Noticeably long neck, legs and tail; bare skin of head and neck pale bluish grey, with patch of short, dense chestnut down on nape; well developed black and white hackles; plumage mainly dark grey, with white spots and vermiculations, and rich blue on underparts; commonly one or more spur-like bumps on each tarsus. Female similar to male, but averages smaller. Juvenile retains some of streaked natal down on head; hackles obvious; plumage generally greyish brown, with rufous-brown, buff and black barring and mottling; blue areas of plumage less

intensely coloured; lacks tarsal bumps.

Habitat. Generally found in drier and more open habitats than other guinea-fowl, especially semi-arid *Acacia/Commiphora* thorn-scrub and grassland with trees and bushes; arid and semi-arid plateau country. On Mt Marsabit, Kenya, found in montane forest; also in tall riverine *Acacia* woodland, when foraging; in areas of sympatry with *Guttera pucherani*, present species sometimes enters dense thickets. Exceptionally ranges as high as 1900 m.

Food and Feeding. Seeds and leaves of grasses and herbs; berries and fruit (*Commiphora*, *Ficus*), roots, bulbs, green buds and shoots. Also takes variety of insects, scorpions, spiders and small

molluscs. Mostly forages on ground, scratching with feet; occasionally climbs up into bushes and low trees (e.g. *Salvadora persica*, *Commiphora*) to feed on berries and fruits. Unlike other guineafowl does not appear to require drinking water, and even when water available in dry season, species does not drink.

Breeding. Probably breeds in or just after rainy season; laying peaks in Jun and Dec-Jan. Nest is simple scrape on ground, situated in cover of fairly dense grass, rock or bush. Up to 13-15 eggs, laid on successive days; eggs creamy white or pale brown, 49.5-55 x 37.3-41 mm. Incubation c. 23-25 days; chicks have yellowish buff down with dark brown mottling.

Movements. Sedentary.

Status and Conservation. Not globally threatened. Mace-Landé Safe. Total population may number over 1,000,000 birds. Generally common to abundant, and apparently stable; may suffer locally from overhunting. Seems to have disappeared from Uganda, where in past was recorded in N Karamoja.

Bibliography. Archer & Godman (1937), Ash & Miskell (1983), Britton (1980), Brewer & Britton (1980), Dekker (1971), Grahame (1969), Mackworth-Praed & Grant (1957), McGowan, Carroll & Ellis-Joseph (1994), Rogers & Norris (1970), Urban *et al.* (1986).

REFERENCES

REFERENCES OF SCIENTIFIC DESCRIPTIONS

- Abdulali & Grubb (1970). *J. Bombay Nat. Hist. Soc.* **67**: 137-138.
- Aldrich (1942). *Proc. Biol. Soc. Washington* **60**: 67.
- Aldrich & Friedmann (1943). *Condor* **45**: 95.
- Alexander (1903). *Bull. Brit. Orn. Club* **13**: 49.
- Alexander (1909). *Bull. Brit. Orn. Club* **25**: 12.
- Allen (1900). *Bull. Amer. Mus. Nat. Hist.* **13**: 127.
- Alphéraky & Bianchi (1908). *Annuaire Mus. Zool. Acad. Imp. Sci. St. Pétersb.* **12** (1907): 440.
- Altum (1894). *J. Orn.* **42**: 268.
- Amadon (1953). *Ibis* **95**: 498.
- Amadon (1964). *Amer. Mus. Novit.* **2166**: 19.
- Anderson (1871). *Proc. Zool. Soc. London*: 214.
- Anthony (1889). *Proc. Calif. Acad. Sci. Ser.* **2**(2): 74.
- Audubon (1827). *Birds Amer.*: 11.
- Audubon (1830). *Birds Amer.*, pl. 86.
- Audubon (1837). *Birds Amer.*, pl. 392.
- Aveledo & Pons (1952). *Nov. Cient. Mus. Hist. LaSalle Ser. Zool.* **7**: 7.
- Baird (1858). *Rep. Expl. & Surv. R. R. Pac.* **9**.
- Bangs (1901). *Auk* **18**: 356. [*Odontophorus gujanensis castigatus*]
- Bangs (1901). *Proc. New England Zool. Club* **2**: 68. [*Buteo jamaicensis umbrinus*]
- Bangs (1907). *Auk* **24**: 289.
- Bangs (1911). *Proc. Biol. Soc. Washington* **24**: 187.
- Bangs (1912). *Auk* **29**: 378.
- Bangs (1913). *Bull. Mus. Comp. Zool.* **54**: 465.
- Bangs (1920). *Proc. New England Zool. Club* **7**: 35.
- Bangs & Noble (1918). *Auk* **35**: 444.
- Bangs & Penard (1918). *Bull. Mus. Comp. Zool.* **62**: 35, 37.
- Bangs & Penard (1919). *Bull. Mus. Comp. Zool.* **63**: 23.
- Bangs & Penard (1920). *Proc. New England Zool. Club* **7**: 46.
- Bangs & Penard (1921). *Proc. Biol. Soc. Washington* **34**: 89.
- Bangs & Peters (1928). *Bull. Mus. Comp. Zool.* **68**: 386.
- Bangs & Phillips (1914). *Bull. Mus. Comp. Zool.* **58**: 268.
- Bannerman (1929). *Bull. Brit. Orn. Club* **49**: 109.
- Barbour (1935). *Occas. Papers Boston Soc. Nat. Hist.* **8**: 207.
- Bartels (1938). *Treubia* **16**: 321-322.
- Bates (1928). *Bull. Brit. Orn. Club* **49**: 33.
- Bechstein (1793). in: Latham, *Allgemeine Uebersicht Vögel* **1**: 655. Anhang.
- Bechstein (1805). *Gem. Nature. Deutschl.* ed. 2, 2: 463.
- Beebe (1912). *Zoologica* **1**: 190.
- Behle & Selander (1951). *Proc. Biol. Soc. Washington* **64**: 125-127.
- Bendire (1893). *Forest & Stream* **40**: 425.
- Benson (1960). *Ibis* **103b**: 36.
- Benson & Elliott (1975). *Bull. Brit. Orn. Club* **95**: 60.
- Bent (1912). *Smithson. Misc. Coll.* **56**(30): 1.
- Berlepsch (1892). *J. Orn.* **40**: 91.
- Berlepsch (1908). *Novit. Zool.* **15**: 297.
- Berlepsch & Stotzmann (1902). *Proc. Zool. Soc. London*, vol. **2**: 45.
- Bertoni (1901). *Anales Cient. Paraguay* **1**: 16, 159.
- Bianchi (1898). *Ann. Mus. Zool. Acad. Imp. St. Pétersb.* **3**: 118, 119.
- Bianchi (1903). *Ann. Mus. Zool. Acad. Imp. St. Pétersb.* **8**(5): 3, 4.
- Bianchi (1906). *Bull. Acad. Imp. Sci. St. Pétersb.* **24**: 83, 84.
- Bianchi (1907). *Aves Exped. Koslowi Mongol et Tibet ox.*: 165.
- Bianchi (1908). *Ann. Mus. Zool. St. Pétersb.* **8**: 4, 5.
- Bishop (1900). *Auk* **17**: 114.
- Bishop (1912). *Auk* **29**: 232.
- Blake (1959). *Feldiana Zool.* **39**: 374-376.
- Blanford (1898). *Avif. Brit. Ind.* **4**: 107.
- Blasius, W. (1897). *Festschr. Techn. Hochschule Braunschwig*: 292.
- Blundell & Lovat (1899). *Bull. Brit. Orn. Club* **10**: 22.
- Blyth (1842). *J. Asiatic Soc. Bengal* **11**: 464.
- Blyth (1843). *J. Asiatic Soc. Bengal* **12**: 128, 179, pt. 2: 1011.
- Blyth (1844). *J. Asiatic Soc. Bengal* **13**: 936.
- Blyth (1845). *J. Asiatic Soc. Bengal* **14**: 173.
- Blyth (1846). *J. Asiatic Soc. Bengal* **15**: 52.
- Blyth (1847). *J. Asiatic Soc. Bengal* **16**: 727.
- Blyth (1850). *J. Asiatic Soc. Bengal* **18**: 819.
- Blyth (1852). *J. Asiatic Soc. Bengal* **21**: 351.
- Blyth (1855). *J. Asiatic Soc. Bengal* **24**: 276.
- Blyth (1856). *J. Asiatic Soc. Bengal* **24**: 277.
- Blyth (1859). *J. Asiatic Soc. Bengal* **28**: 415.
- Blyth (1861). *J. Asiatic Soc. Bengal* **30**: 193.
- Blyth (1863). *Ibis*: 118.
- Blyth (1865). *Ibis*: 28.
- Bocage (1869). *J. Sci. Math. Phys. e Nat., Acad. Real Sci. Lisboa* **2**: 350.
- Bocage (1881). *Orn. Angola*, pt. 2: 406.
- Boddaert (1783). *Table Planches Enlum.*: 25, 28.
- Bogdanov (1879). *Trudy Obshchestva Estest Imp. Kazanskom Univ.* **8**(4): 45.
- Bonaparte (1827). *Zool. Journ.* **3**: 213.
- Bonaparte (1828). *Amer. Orn.* **2**: 1.
- Bonaparte (1838). *Geogr. Comp. List Birds Europe North Amer.*: 4, 42.
- Bonaparte (1850). *Consp. Gen. Avium* **1**: 9, 19, 23, 27, 33, 34. [*Coragyps atratus brasiliensis*, *Accipiter trinatoratus*, *Leucopernis kuhli*, *Falco moluccensis*, *Falco peregrinus minor*]
- Bonaparte (1850). *Proc. Zool. Soc. London* (1849): 145. [*Agelastes*, *Agelastes melanocephalus*]
- Bonaparte (1850). *Rev. Mag. Zool. Paris* (Ser. 2) **2**: 482, 487. [*Macheiramphus*, *Macheiramphus alcinus*, *Hiernaetus spilogastris*]
- Bonaparte (1853). *Compt. Rend. Acad. Sci. Paris* **37**: 810. [*Accipiter superciliosus fontanieri*]
- Bonaparte (1853). *Rev. Mag. Zool. Paris* (Ser. 2) **5**: 578. [*Accipiter castanilius*]
- Bonaparte (1854). *Rev. Mag. Zool. Paris* (Ser. 2) **6**: 533.
- Bonaparte (1856). *Compt. Rend. Acad. Sci. Paris* **42**: 875, 877, 878, 880, 882, 883, 954. [*Penelope argyrotis*, *Penelope montagnii*, *Pipile*, *Tetrao parvirostris*, *Colinus leucopogon sclateri*, *Francolinus francolinus henrici*, *Francolinus francolinus azae*]
- Bonaparte (1856). *Compt. Rend. Acad. Sci. Paris* **43**: 414, 415. [*Ophrysia*, *Lophura diardi*]
- Bonaparte (1858). *J. Orn.* **6**: 31.
- Bond (1936). *Proc. Acad. Nat. Sci. Philadelphia* **88**: 355.
- Bond & Meyer de Schauensee (1939). *Nat. Naturae* **29**.
- Bonnaterre (1791). *Tabl. Encyc. Méth. Orn.*, pt. 1.
- Bonnaterre (1792). *Tabl. Encyc. Méth. Orn.*, pt. 1: 208.
- Bosc (1792). *J. Hist. Nat. Paris* **2**: 297.
- Boulton (1932). *Proc. Biol. Soc. Washington* **45**: 235.
- Bourne (1955). *Bull. Brit. Orn. Club* **75**: 36.
- Brandt, J.F. (1843). *Bull. Acad. Imp. Sci. St. Pétersb., Physico-Math. Cl.* **1**, col. 365.
- Brandt, J.F. (1844). *Bull. Acad. Imp. Sci. St. Pétersb., Physico-Math. Cl.* **3**: 51.
- Brehm, A.E. (1852). *Naumannia* **2**(3): 44.
- Brehm, A.E. (1857). *Allg. Deutsche Nat. Zeit., N.F.* **3**: 472.
- Brehm, C.L. (1824). *Lehrb. Nat. eur. Vög.* **2**: 986.
- Brehm, C.L. (1827). *Ornis* **3**: 9.
- Brehm, C.L. (1831). *Handb. Naturgeschichte Vögel Deutschlands*: 27, 503, 513.
- Brehm, C.L. (1855). *Vollständige Vogelfang*: 29.
- Brehm, C.L. (1861). *Ber. XIII. Versammlung Deutschen Ornith.-Gesell.* (1860): 60.
- Brewster (1881). *Bull. Nuttall Orn. Cl.* **6**: 72.
- Brewster (1883). *Bull. Nuttall Orn. Cl.* **8**: 33, 34.
- Brewster (1885). *Auk* **2**: 82, 194, 199.
- Brisson (1760). *Orn.* **1**.
- Brodkorb (1942). *Occ. Pap. Mus. Zool. Univ. Mich.* **467**: 1.
- Brown, T. (1846). *Illus. Gen. Birds*, pt. **8**: 12.
- Brüggemann (1876). *Abh. Naturwissen Verein Bremen* **5**: 47.
- Brüggemann (1877). *Abh. Naturwissen Verein Bremen* **5**: 461.
- Bruun, Mendelssohn & Bull (1981). *Bull. Brit. Orn. Club* **101**: 244-247.
- Burchell (1824). *Travels Interior Southern Africa* **2**: 195, 329.
- Burmeister (1856). *Syst. Uebers. Th. Bras.* **3**: 347.
- Burns (1911). *Wilson Bull.* **23**: 148.
- Büttikofer (1889). *Notes Leyden Mus.* **11**: 76.
- Buturlin (1904). *Ibis*: 390,393, 407. [*Phasianus colchicus zarudnyi*, *Phasianus colchicus bianchii*, *Phasianus colchicus kiangsuensis*]
- Buturlin (1904). *Orn. Monatsb.* **15**. 81. [*Phasianus colchicus karpowii*]
- Buturlin (1906). *Ibis*: 409, 411.
- Buturlin (1907). *Orn. Monatsber.* **15**: 81.
- Buturlin (1908). *Ibis*: 576.
- Buturlin (1916). *Orn. Mitt.* **7**: 226, 227.
- Cabanis (1851). in: Ersch & Gruber, *Allg. Encyc.*, sect. **1**, 53: 221.
- Cabanis (1854). *J. Orn.* **2**: 369.
- Cabanis (1855). *J. Orn.* **2** (1854): 80.
- Cabanis (1865). *J. Orn.* **13**: 406.
- Cabanis (1869). in: Decken. *Reisen Ost-Afrika* **3**, Abth. **1**: 40.
- Cabanis (1878). *J. Orn.* **26**: 206, 243.
- Cabanis (1882). *J. Orn.* **30**: 229.
- Cassin (1845). *Proc. Acad. Nat. Sci. Philadelphia* **2**: 212.
- Cassin (1847). *J. Acad. Nat. Sci. Philadelphia* **1**: 21.
- Cassin (1848). *Proc. Acad. Nat. Sci. Philadelphia* **4**: 87.
- Cassin (1856). *Proc. Acad. Nat. Sci. Philadelphia* **7** (1855): 281.
- Cassin (1857). *Proc. Acad. Nat. Sci. Philadelphia* **8**: 321, 322.
- Cassin (1865). *Proc. Acad. Nat. Sci. Philadelphia*: 2, 4.
- Castroviejo (1967). *J. Orn.* **108**: 220-221.
- Chapin (1921). *Amer. Mus. Novit.* **7**: 1.
- Chapin (1936). *Rev. Zool. et Bot. Afr. Tervueren* **29**: 1-6.
- Chapin (1937). *Rev. Zool. et Bot. Afr. Tervueren* **29**.
- Chapman (1902). *Bull. Amer. Mus. Nat. Hist.* **16**: 236.
- Chapman (1904). *Bull. Amer. Mus. Nat. Hist.* **20**: 159.
- Chapman (1912). *Bull. Amer. Mus. Nat. Hist.* **31**: 141.
- Chapman (1915). *Bull. Amer. Mus. Nat. Hist.* **34**: 365, 375, 379.
- Chapman (1921). *Amer. Mus. Novit.* **18**: 3, 4.
- Chapman (1925). *Amer. Mus. Novit.* **205**: 1.
- Chapman (1929). *Amer. Mus. Novit.* **380**: 3.
- Chasen (1934). *Bull. Raffles Mus.* **9**: 93.
- Chasen (1939). *Treubia* **17**: 184.
- Chasen & Hoogerwerf (1941). *Treubia* (1941) **Suppl.**: 17.
- Chasen & Kloss (1926). *Ibis*: 278.
- Cheng & Wu (1979). *Acta Zool. Sinica* **25**: 292-294.
- Cheng, Chang & Tang (1964). *Acta Zootaxonomica Sinica* **1**(2): 221-228.
- Cherrie & Reichenberger (1921). *Amer. Mus. Novit.* **27**: 2.
- Children (1826). in: Denham & Clapperton (1826). *Travels* app. **XXI**: 198.
- Chubb (1917). *Bull. Brit. Orn. Club* **38**: 4, 5.
- Chubb (1918). *Bull. Brit. Orn. Club* **39**: 21, 22.
- Chubb (1919). *Ibis*: 26, 27.
- Clancey (1960). *Durban Mus. Novit.* **6**: 15.
- Clancey (1987). *Bull. Brit. Orn. Club* **107**(4): 173-177.
- Clark (1905). *Proc. Biol. Soc. Washington* **18**: 62.
- Clark (1907). *Proc. US Nat. Mus.* **32**: 469, 470.
- Condon & Amadon (1954). *Rec. S. Austr. Mus.* **11**: 189-246.
- Conover (1930). *Proc. Biol. Soc. Washington* **43**: 3.
- Conover (1932). *Condor* **34**: 174.

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- Conover (1935). *Condor* 37: 204.
- Conover (1937). *Proc. Biol. Soc. Washington* 1: 73, 74.
- Conover (1938). *Proc. Biol. Soc. Washington* 51: 53.
- Cory (1883). *Quart. J. Boston Zool. Soc.* 2: 46.
- Cory (1915). *Field Mus. Nat. Hist. Publ. Orn. Ser.* 1: 294, 296, 298, 318.
- Coues (1872). *Key North Amer. Birds*: 237.
- Cowan (1939). *Condor* 41: 82.
- Cretschmar (1827). in: Rüppell, *Atlas Reise Nördl. Afrika, Vögel* (1826): 40.
- Cuvier (1817). *Règne Animal* (1816) 1: 322.
- Cuvier (1820). *Mém. Mus. Hist. Nat.* 6: 1, 4.
- Cuvier (1829). *Règne Animal*, nouv. éd. 1: 479.
- Danforth & Smyth (1935). *J. Agric. Univ. Puerto Rico* 19: 485.
- Dauidin (1800). *Traité Orn.* 2.
- David (1873). *Ann. Sci. Nat. Zool.* 18(5): 1.
- David & Oustalet (1877). *Oiseaux Chine*: 408.
- Deignan (1948). *Auk* 65: 284.
- Delacour (1926). *Bull. Brit. Orn. Club* 47: 9.
- Delacour (1927). *Bull. Brit. Orn. Club* 47: 151, 152, 169.
- Delacour (1945). *Zoologica* 80: 44.
- Delacour (1948). *Amer. Mus. Novit.* 1377: 7.
- Delacour (1949). *Ibis* 348-349.
- Delacour & Jabouille (1924). *Bull. Brit. Orn. Club* 45: 28, 29, 30.
- Delacour & Jabouille (1928). *Bull. Brit. Orn. Club* 48: 125-129.
- Delacour & Jabouille (1930). *Rev. Hist. Nat., 2ème partie, L'Oiseau* 11: 408.
- Delacour & Kinnear (1928). *Bull. Brit. Orn. Club* 49: 49.
- Delegorgue (1847). *Voy. Afr. Austr.* 2: 615.
- Dementiev (1931). *Orn. Minutier* 39: 54.
- Dementiev (1951). *Prisys Sovetskogo Soiuza* 1: 312.
- Deppe (1830). *Preis-Verzeichniss Säugethiere Vogel Deppe Schiede Mexico Gesammelt*: 3.
- Des Murs (1845). *Rev. Zool. Paris* 8: 175 bis.
- Des Murs (1853). *Rev. Mag. Zool. Paris (Ser. 2)* 5: 154.
- Desfayes (1974). *Bull. Brit. Orn. Club* 94: 70.
- Desfontaines (1789). *Hist. Acad. Roy. Sci. Paris* (1787): 503.
- Dickey & van Rossem (1923). *Condor* 25: 168.
- Dickey & van Rossem (1928). *Proc. Biol. Soc. Washington* 41: 129.
- Dickey & van Rossem (1930). *Condor* 32: 73.
- Dillwyn (1853). *Proc. Zool. Soc. London* (1851): 119.
- Dinesen, Lehnberg, Svendsen, Hansen & Fjeldså (1994). *Ibis* 136: 3-11.
- Domaniewski (1933). *Acta Orn. Mus. Zool. Polon.* 1(6).
- Dombrowski (1912). *Ornis Romaniae*. Bucharest.
- Dorst & Jouanin (1952). *Oiseau* 22: 71-74.
- Douglas (1829). *Philos. Mag.* 5: 74. [*Oreortyx pictus*]
- Douglas (1829). *Trans. Linn. Soc. London* 16: 137, 139, 141, 148. [*Falcipennis canadensis franklinii*, *Dendragapus obscurus richardsonii*, *Bonasa umbellus umbelloides*, *Bonasa umbellus sabini*]
- Drapiez (1824). in: Bory de Saint-Vincent, *Dict. Class. Hist. Nat.* 6: 412.
- Dresser (1902). *Ibis*: 656.
- Du Bus de Gisignies (1845). *Esquisses Orn.*, livr. 1.
- Du Bus de Gisignies (1847). *Bull. Acad. Roy. Sci. Lettres Beaux-Arts Belgique* 14 pt. 2: 102.
- Dubois (1905). *Ann. Mus. Congo. Zool.* 1(4) fasc. 1: 17.
- Dugand (1943). *Caldasia* 2: 194.
- Duméril (1806). *Zool. Analytique*: 32.
- Dumont (1816). *Dict. Sci. Nat.* 1(Suppl.): 88.
- Dumont (1820). *Dict. Sci. Nat.* 16: 217.
- Dumont (1823). *Dict. Sci. Nat.* (éd. Levrault) 29: 416.
- Elliott (1864). *Proc. Acad. Nat. Sci. Philadelphia*: 23.
- Elliott (1865). *Ibis*: 424.
- Elliott (1866). *Ibis*: 56.
- Elliott (1870). *Ann. Mag. Nat. Hist.* 6(4): 312. [*Phasianus colchicus elegans*]
- Elliott (1870). *Proc. Zool. Soc. London*: 403, 406. [*Guttera pucherani verreauxi*, *Phasianus colchicus shawii*, *Phasianus colchicus formosanus*]
- Elliott (1871). *Ann. Mag. Nat. Hist.* 8(4): 119.
- Elliott (1896). *Auk* 13: 25, 26.
- Elliott (1897). *Publ. Field Mus. Nat. Hist. Orn. Ser.* 1: 58.
- Elwes (1881). *Ibis*: 399.
- Erlander (1897). *Orn. Monatsber.* 5: 187.
- Eyton (1845). *Ann. & Mag. Nat. Hist.* 16: 230.
- Faber (1822). *Præd. Isl. Orn.*: 6.
- Fischer & Reichenow (1884). *J. Orn.* 32: 179, 263.
- Fleischer (1818). in: Laroup & Fischer's *Sylvan for 1817/1818*, p. 174.
- Fleming (1822). *Philos. Zool.* 2: 230.
- Fleming, R.L. (1947). *Fieldiana Zool.* 31: 93.
- Floerike (1903). *Mitt. Reichsb. Vogelkunde Vogelschutz* 3: 64.
- Forster, J.R. (1781). *Indum Zool.*: 25.
- Forster, J.R. (1791). in: Levaillant, *Reise Innere Afrika* 3: 363.
- Forster, J.R. (1798). in: Levaillant, *Naturgeschichte Afr. Vögel*: 35, 59.
- Franklin (1831). *Proc. Com. Sci. Corresp. Zool. Soc. London* pt. 1: 114, 115.
- Fraser (1850). *Proc. Zool. Soc. London*: 246.
- Friedmann (1928). *Proc. Biol. Soc. Washington* 41: 94.
- Friedmann (1934). *J. Washington Acad. Sci.* 24: 313, 314.
- Friedmann (1935). *J. Washington Acad. Sci.* 25: 451.
- Friedmann (1943). *J. Washington Acad. Sci.* 33: 190, 273, 369, 370, 371.
- Friedmann (1944). *Proc. Biol. Soc. Wash.* 57: 16.
- Friedmann (1950). *Smithsonian Misc. Coll.* 111(16): 1.
- Gabrielson & Lincoln (1959). *The Birds of Alaska*, Stackpole Co., Harrisburg, PA, & Wildlife Management Institute, Washington D.C.
- Gaimard (1823). *Bull. Gén. Univ. Annon. Nouv. Sci.* 2: 451.
- Gambel (1843). *Proc. Acad. Nat. Sci. Philadelphia*: 260.
- Gambel (1848). *Proc. Acad. Nat. Sci. Philadelphia* 9: 77.
- Garnot (1828). in: Duperrey, *Voyage Coquille*, *Zool. Atlas* 1.
- Gebler (1836). *Bull. Sci. Acad. Imp. Sci. St. Pétersb.* 1: 31.
- Gené (1839). *Rev. Zool. Paris* 2: 105.
- Geoffroy Saint-Hilaire (1835). *Mag. Zool. Paris* 5.
- Geoffroy Saint-Hilaire (1853). in: Le Maout, *Hist. Nat. Oiseaux*: 66.
- Geoffroy Saint-Hilaire & Verreaux (1866). *Bull. Soc. d'Acclimat.* 3(2): 223.
- Ghigi (1905). *Mem. R. Acad. Sci. Inst. Bologna* 2(6): 194, 196.
- Gilliard (1940). *Amer. Mus. Novit.* 1071: 1-3.
- Gloger (1833). *Abtndern Vögel Einfluss Klima's*: 141.
- Gloger (1841). *Hand- und Hilfsbuch Naturgeschichte*: 236.
- Gloger (1842). *Hand- und Hilfsbuch Naturgeschichte* (1841): 396.
- Gmelin (1788). *Syst. Nat.* 1.
- Gmelin (1789). *Syst. Nat.* 1.
- Gmelin, S.G. (1770). *Reise Russland* 1: 48.
- Gmelin, S.G. (1784). *Reise Russland* 4: 67.
- Godwin-Austen (1874). *Proc. Zool. Soc. London*: 44.
- Gould (1820). *Handb. Zool.* 2: 220.
- Gould (1837). *Proc. Zool. Soc. London* (1836): 9, 10, 75. [*Buteo galapagoensis*, *Buteo ventralis*, *Phalacrocorax albobularis*, *Cyrtornis ocellatus*]
- Gould (1837). *Synop. Birds Australia* pt. 2. [*Coturnix pectoralis*]
- Gould (1838). *Proc. Zool. Soc. London* (1837): 9, 10, 79, 42. [*Gallinago tenuis*, *Oreortyx pictus nummulus*]
- Gould (1838). *Synop. Birds Australia* pt. 3 & 4. [*Alcedo subcristata*, *Milvus migrans affinis*, *Lophoceros curia*]
- Gould (1840). *Synop. Birds Australia* pt. 1.
- Gould (1841). *Proc. Zool. Soc. London* (1840): 161, 162.
- Gould (1842). *Birds Australia* pt. 9 (1 December).
- Gould (1843). *Proc. Zool. Soc. London* (1842): 181-183.
- Gould (1844). *Proc. Zool. Soc. London* (1843): 107, 132-134. [*Dendrortyx leucophrys*, *Philortyx fasciatus*, *Colinus cristatus leucotis*, *Odontophorus guianensis marmoratus*, *Odontophorus strophium*]
- Gould (1844). *Birds Australia* pt. 16 (1 September). [*Falco bergora occidentalis*]
- Gould (1844). *Monogr. Odontoph.* pt. 1. [*Dendrortyx, Cyrtornyx*]
- Gould (1846). *Monogr. Odontoph.* pt. 2. [*Dendrortyx barbatus*, *Philortyx*]
- Gould (1846). *Proc. Zool. Soc. London*: 69. [*Odontophorus balliviani*]
- Gould (1850). *Monogr. Odontoph.* pt. 3.
- Gould (1851). *Birds Asia* pt. 3: pt. 4, 5.
- Gould (1854). *Proc. Zool. Soc. London* (1853): 47.
- Gould (1855). *Proc. Zool. Soc. London* (1854): 99, 100.
- Gould (1856). *Proc. Zool. Soc. London* 24: 61-63.
- Gould (1857). *Proc. Zool. Soc. London*: 161.
- Gould (1858). *Proc. Zool. Soc. London* (1857): 222, 223.
- Gould (1859). *Proc. Zool. Soc. London*: 99, 127, 128.
- Gould (1860). *Proc. Zool. Soc. London*: 62, 382.
- Gould (1863). *Birds Asia* pt. 15. [*Spizaetus philippensis*]
- Gould (1863). *Proc. Zool. Soc. London* (1862): 284, 285. [*Bambusicola, Bambusicola thoracica sonorivox*, *Lophura swinhoi*]
- Gould (1866). *Ann. Mag. Nat. Hist.* 17(3): 150.
- Gray, G.R. (1831). *Illus. Ind. Zool.* 1 pt. 8.
- Gray, G.R. (1840). *List Gen. Birds*: 3, 5, 61.
- Gray, G.R. (1841). *List Gen. Birds*: ed. 2.
- Gray, G.R. (1843). *Ann. Mag. Nat. Hist.* 11: 371. [*Falco subniger*]
- Gray, G.R. (1843). *Proc. Zool. Soc. London* (1842): 105. [*Tetrao gallus himalayensis*]
- Gray, G.R. (1844). *Gen. Birds* 1: 6, 3: 485.
- Gray, G.R. (1846). *Gen. Birds* 3: 514.
- Gray, G.R. (1858). *Proc. Zool. Soc. London*: 169, 170.
- Gray, G.R. (1859). *Proc. Zool. Soc. London*: 153.
- Gray, G.R. (1860). *Proc. Zool. Soc. London*: 270, 342, 343, 344, 362.
- Gray, G.R. (1861). *Proc. Zool. Soc. London*: 289.
- Gray, G.R. (1864). *Ann. Mag. Nat. Hist.* (Ser. 3) 14: 378. [*Megapodius pritchardii*]
- Gray, G.R. (1864). *Proc. Zool. Soc. London*: 259. [*Pucrasia maculosa xanthospila*]
- Gray, G.R. (1867). *List Birds Brit. Mus., Gallinae*: 10, 11, 12, 48, 50, 52.
- Gray, G.R. (1870). *Ann. Mag. Nat. Hist.* (Ser. 4) 5: 327, 328.
- Gray, J.E. (1829). in: Griffith, *Anim. Kingd.* 8 (Aves 3): 25, 27, 29.
- Gray, J.E. (1830). in: Gray & Hardwicke, *Ill. Ind. Zool.* 1 pt. 2: 54.
- Gray, J.E. (1831). *Zool. Misc.* pt. 1: 4. [*Alcedura lathamii*]
- Gray, J.E. (1831). in: Gray & Hardwicke, *Ill. Ind. Zool.* 1 pt. 8, pl. 18, 55. [*Milvus migrans lineatus*, *Francolinus pictus pallidus*]
- Gray, J.E. (1831). in: Gray & Hardwicke, *Ill. Ind. Zool.* 1 pt. 9: 50. [*Tragopan temminckii*]
- Gray, J.E. (1832). *Ill. Ind. Zool.* 2 pt. 11: 46.
- Gray, J.E. (1834). in: Gray & Hardwicke, *Ill. Ind. Zool.* 2.
- Gray, J.E. (1846). *Knowsley Menagerie* 1: 8, pl. 16.
- Greenway (1933). *Bull. Mus. Comp. Zool. Harv.* 74: 113.
- Grinnell (1906). *Auk* 23: 262.
- Grinnell (1909). *Univ. Calif. Publ. Zool.* 5: 204, 207, 211.
- Grinnell (1910). *Univ. Calif. Publ. Zool.* 5: 380, 383.
- Grinnell (1916). *Condor* 18: 166.
- Grinnell (1926). *Condor* 28: 128.
- Griscom (1930). *Amer. Mus. Novit.* 414: 1.
- Gunning & Roberts (1911). *Ann. Transvaal Mus.* 3: 110.
- Gurney (1862). *Ibis*: 149.
- Gurney (1863). *Ibis*: 34.
- Gurney (1866). *Proc. Zool. Soc. London* (1865): 618.
- Gurney (1868). *Ibis*: 253.
- Gurney (1875). *Ibis*: 358.
- Gurney (1876). *Ibis*: 73.
- Gurney (1879). *Ibis*: 176.
- Gurney (1882). *Ibis*: 128, 453.
- Gurney (1884). *List Diurnal Birds Prey*: 148, 156, 158.
- Gurney (1898). *Bull. Brit. Orn. Club* 7: 27.
- Hablitz (1783). *Neue Nordische Beytr.* 4: 58, 64.
- Hachisuka (1938). *Bull. Brit. Orn. Club* 58: 19.
- Hardwicke (1821). *Trans. Linn. Soc. London* 13 pt. 1: 237.
- Hardwicke (1827). *Trans. Linn. Soc. London* 15.
- Hardwicke (1834). *Proc. Zool. Soc. London*: 52.
- Hartert (1894). *Bull. Brit. Orn. Cl.* 3: 37.
- Hartert (1897). *Novit. Zool.* 4: 271.
- Hartert (1898). *Novit. Zool.* 5: 46.
- Hartert (1903). *Novit. Zool.* 10: 3.
- Hartert (1910). *Novit. Zool.* 17: 209.
- Hartert (1913). *Vogel Pal. Fauna*: 1086.
- Hartert (1914). *Bull. Brit. Orn. Club* 33: 89. [*Milvus milvus fasciicauda*]
- Hartert (1914). *Vogel Pal. Fauna*: 1165. [*Melierax metabates neumanni*]
- Hartert (1917). *Novit. Zool.* 24.
- Hartert (1919). *Bull. Brit. Orn. Club* 39: 69. [*Numida meleagris sabvi*]
- Hartert (1919). *Bull. Brit. Orn. Club* 40: 4. [*Ammoperdix heyi nicolli*]
- Hartert (1921). *Vogel Pal. Fauna* 3: 1869.
- Hartert (1923). *British Birds* 17: 106.
- Hartert (1925). *Novit. Zool.* 32: 137, 269.
- Hartert (1926). *Novit. Zool.* 33: 33-48.
- Hartert (1930). *Novit. Zool.* 36: 125.
- Hartert & Neumann (1907). *J. Orn.* 55: 592.
- Hartert & Neumann (1914). *Orn. Monatsber.* 22: 31.
- Hartert & Neumann (1932). *J. Orn.* 80: 531.
- Hartlaub (1849). *Rev. Mag. Zool.* 1(2): 495.
- Hartlaub (1854). *J. Orn.* 2: 210.
- Hartlaub (1855). *J. Orn.* 3: 39, 353, 354.
- Hartlaub (1860). *J. Orn.* 8: 11, 341. [*Buteo brachypterus*, *Guttera pucherani*]
- Hartlaub (1860). *Proc. Zool. Soc. London*: 109. [*Falco longipennis meridionalis*]
- Hartlaub (1861). *Orn. Beitr. Fauna Madagascars*: 17.
- Hartlaub (1866). *Proc. Zool. Soc. London* (1865): 665.
- Hartlaub (1867). *J. Orn.* 15: 36. [*Guttera pucherani eduanii*]
- Hartlaub (1867). *Proc. Zool. Soc. London*: 830. [*Megapodius lapemuse senex*, *Megapodius eremita*]
- Hartlaub (1879). *Sitzungsab. 7 Ver. naturwiss. Unterh. Hamburg*: 3.
- Heine (1890). *Nomencl. Mus. Heineani Orn.*: 270.
- Hellmayr (1906). *Ahh. K. Bav. Akad. Wiss. Kl.* 2 22: 694, 695.
- Hellmayr (1914). in: Haniel, *Zool. Timor* 1: 100. [*Falco longipennis hanieli*]
- Hellmayr (1914). *Novit. Zool.* 21: 178. [*Penelope obscura bromzina*]
- Hellmayr (1917). *Verh. Orn. Gesell. Bayern* 13: 200.
- Hellmayr & Conover (1932). *Auk* 49: 328, 333.
- Hellmayr & Conover (1942). *Publ. Field Mus. Nat. Hist. Zool. Ser.* 13 pt. 1(1).
- Hermann (1783). *Tabula Affinitatum Animalium*: 136, 235.
- Hesse (1912). *Orn. Monatsber.* 20: 101.
- Heude (1883). *Ibis*: 225.
- Heuglin (1861). *Ibis*: 69, 72.
- Heuglin (1863). *J. Orn.* 11: 275.
- Hodgson (1833). *Asiatic Researches* 18 pt. 2: 13. [*Aquila nipalensis*]

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- van Oort (1910). *Notes Leyden Mus.* 32: 211, 212.
- d'Orbigny (1834). *Voyage Amérique Méridionale*, livr. 2.
- Ord (1815). in: Guthrie's Geogr., 2nd Amer. ed. 2: 317.
- Orr & Webster (1968). *Proc. Biol. Soc. Wash.* 81: 37-40.
- Osgood (1901). *Auk* 18: 180.
- Ouellet (1990). *Can. Field Nat.* 104(3): 445-449.
- Oustalet (1875). *Bull. Soc. Philomath. Paris* (Ser. 6) 12: 25.
- Oustalet (1876). *Bull. Soc. Philomath. Paris* (Ser. 6) 13: 57.
- Oustalet (1880). *Compt. Rend. Acad. Sci. Paris* 90: 906, 907.
- Oustalet (1891). *Ann. Sci. Nat. Zool.* (7) 12: 296, 313.
- Oustalet (1896). *Bull. Mus. Hist. Nat. Paris* 2: 316, 317.
- Oustalet (1898). *Bull. Mus. Hist. Nat. Paris* 4: 258.
- Pallas (1767). *Spic. Zool.* 114: 13, 15, 18.
- Pallas (1771). *Reise Verschiedene Provinzen Russischen Reichs.* 1: 454.
- Pallas (1811). *Zoographia Rosso-Asiat.* 1: 343, 351. [*Haliaeetus pelagicus*, *Aquila clanga*]
- Pallas (1811). *Zoographia Rosso-Asiat.* 2: 76, 86. [*Tetraogallus caucasicus*, *Perdix dauurica*, *Crossopilon auritum*]
- Parkes (1973). *Nemoura* 11: 17.
- Peale (1848). *US Explor. Exped.* 8: 62, 64, 68.
- Pelzeln (1858). *Sitzungs. K. Akad. Wiss. Wien, Math-naturw. Cl.* 31: 328.
- Pelzeln (1861). *Sitzungs. K. Akad. Wiss. Wien, Math-naturw. Cl.* 44 pt. 1: 7.
- Pelzeln (1870). *Orn. Brus. Abth.* 3: 287, 284, 337, 341.
- Pennant (1769). *Ind. Zool.*: 2.
- Peters (1913). *Auk* 30: 370, 371.
- Peters (1923). *Proc. New Engl. Zool. Cl.* 8: 79.
- Peters (1929). *Bull. Mus. Comp. Zool.* 69: 404, 405.
- Peters (1934). *Cheek-list of Birds of the World*. Vol. 2. Harvard University Press, Cambridge, MA. Page 25.
- Peters (1935). *Proc. Biol. Soc. Washington* 48: 72.
- Peters & Griscom (1929). *Proc. New England Zool. Club* 11: 48.
- Peters, W. (1854). *Ber. Verh. Akad. Wiss. Berlin* (1853): 783.
- Pheips & Gilliard (1940). *Amer. Mus. Novit.* 1100: 3.
- Philippi (1899). *Anales Univ. Chile* 103: 664.
- Philippi & Landbeck (1864). *Archiv Naturgeschichte* 30 pt. 1: 43.
- Phillips (1959). *Sobretiro de los Anales del Instituto de Biología* 24(1958): 361-374.
- Phillips (1966). *Bull. Brit. Orn. Club* 86: 86-94.
- Picchi (1903). *Avicula* 7: 40.
- Pleske (1888). *Proc. Zool. Soc. London*: 415.
- Pleske (1892). *Bull. Acad. Imp. Sci. St. Pétersb.* 3: 136.
- Poliakov (1915). *Orn. Mitt.* 6: 38.
- Pontoppidan (1763). *Danske Atlas* 1: 616.
- Portenko (1929). *Bull. Acad. Sci. USSR, Cl. Sci. Phys-Math.*: 644.
- Portenko (1931). *Mitt. Zool. Mus. Berlin* 17: 416.
- Potapov (1985). [*Fauna of the USSR. Birds*] Leningrad.
- Przewalski (1876). *Mongol i Strana Tangut* 2: 116-130.
- Quoy & Gaimard (1824). in: Freycinet, *Voyage Uranie Physicienne, Zool.*, livr. 3: 91, 92.
- Radde (1863). *Reisen Süden Ost-Sibirien* 2: 102.
- Raffles (1822). *Trans. Linn. Soc. London* 13 pt. 2: 277-331.
- Rafinesque (1815). *Analyse*: 219.
- Ramsay (1879). *Proc. Linn. Soc. New South Wales* 4: 465.
- Ramsay (1881). *J. Linn. Soc. London* 16: 131.
- Ramsay (1882). *J. Linn. Soc. London* 16: 130.
- Rand (1940). *Amer. Mus. Novit.* 1072: 1.
- Rand (1941). *Amer. Mus. Novit.* 1102: 1.
- Rand (1942). *Bull. Amer. Mus. Nat. Hist.* 79.
- Rea (1973). *Condor* 97: 322-329.
- Reichenbach (1853). *Av. Syst. Nat.* (1852): 26.
- Reichenbach (1862). *Av. Syst. Nat., Columbariae*: 152, 154.
- Reichenow (1887). *J. Orn.* 35: 51, 52.
- Reichenow (1892). *Ber. März-Sitz., Deutsche Orn. Ges.* 5.
- Reichenow (1894). *Orn. Monatsber.* 2: 125, 145.
- Reichenow (1895). *J. Orn.* 43: 110. [*Alectoris barbara spatzi*]
- Reichenow (1895). *Orn. Monatsber.* 3: 97. [*Accipiter tuchiro sparsimfasciatus*]
- Reichenow (1896). *Orn. Monatsber.* 4: 76.
- Reichenow (1898). *Orn. Monatsber.* 6: 88, 115.
- Reichenow (1899). *Orn. Monatsber.* 7: 189.
- Reichenow (1900). *Orn. Monatsber.* 8: 40, 185.
- Reichenow (1908). *Orn. Monatsber.* 16: 81.
- Reichenow (1909). *Orn. Monatsber.* 17: 41, 88.
- Reichenow (1912). *J. Orn.* 60: 320.
- Reichenow (1914). *Orn. Monatsber.* 22: 29.
- Reichenow (1919). *J. Orn.* 67: 334.
- Reichenow & Neumann (1895). *Orn. Monatsber.* 3: 114.
- Reinhardt (1879). *Vidensk. Medd. Naturhist. Foren. København*: 5.
- Rensch (1931). *Mitt. Zool. Mus. Berlin* 17: 473, 509.
- Richardson (1831). in: Wilson & Bonaparte, *Amer. Orn.* 4: 330.
- Richmond (1902). *Proc. US Nat. Mus.* 25: 304, 310.
- Richmond (1903). *Proc. US Nat. Mus.* 26: 492.
- Ridgway (1871). *Proc. Acad. Nat. Sci. Philadelphia* (1870): 145.
- Ridgway (1873). *Bull. Essex Inst., Salem, Mass.* 5: [*Falco columbarius suckleyi*, *Falco peregrinus pealei*, *Dendragapus obscurus fuliginosus*, *Tympanuchus pallidicinctus*]
- Ridgway (1873). *Proc. Boston Soc. Nat. Hist.* 16: 87, 88. [*Buteo magnirostris griseocauda*]
- Ridgway (1874). in: Baird, Brewer & Ridgway, *Hist. North Amer. Birds* 3: 208, 209, 250, 285.
- Ridgway (1884). *Proc. Biol. Soc. Washington* 2: 93, 94.
- Ridgway (1885). *Proc. US Nat. Mus.* 7: 514. [*Buteo lineatus alleni*]
- Ridgway (1885). *Proc. US Nat. Mus.* 8: 94. [*Buteo magnirostris gracilis*]
- Ridgway (1887). *Man. No. Amer. Bird*: 209. [*Ortalis vetula pallidiventris*]
- Ridgway (1887). *Proc. US Nat. Mus.* 10: 148. [*Callipepla douglasii bensoni*]
- Ridgway (1888). *Proc. US Nat. Mus.* 10: 593.
- Ridgway (1920). *Smithsonian Misc. Coll.* 72(4): 1.
- Riley (1908). *Auk* 25: 273.
- Riley (1911). *Proc. Biol. Soc. Washington* 24: 233.
- Riley (1915). *Proc. Biol. Soc. Washington* 28: 161.
- Riley (1916). *Proc. Biol. Soc. Washington* 29: 17.
- Riley (1919). *Proc. Biol. Soc. Washington* 32: 93.
- Riley (1925). *Proc. Biol. Soc. Washington* 38: 9.
- Riley (1930). *Proc. Biol. Soc. Washington* 43: 189.
- Ripley (1957). *Postilla* 31: 1-2.
- Ripley & Watson (1963). *Postilla. Peabody Mus. Nat. Hist. Yale Univ.* 77: 2.
- Risjachi (1799). *Diss. Falcone Canorr.* 1.
- Roberts (1917). *Ann. Transv. Mus.* 6: 2.
- Roberts (1929). *Ann. Transv. Mus.* 13: 72.
- Robinson (1904). *Bull. Brit. Orn. Club* 15: 28.
- Robinson & Kloss (1919). *Ibis*: 403.
- Robinson & Kloss (1920). *Records Indian Mus.* 19: 14, 15.
- van Rossem (1932). *Trans. San Diego Soc. Nat. Hist.* 7: 132, 151.
- van Rossem (1935). *Condor* 37: 215.
- van Rossem (1937). *Condor* 39: 22.
- van Rossem (1939). *Auk* 56.
- van Rossem (1946). *Condor* 48: 265.
- van Rossem (1948). *Proc. Biol. Soc. Washington* 61: 67.
- Rothschild (1897). *Bull. Brit. Orn. Club* 7: 6.
- Rothschild (1901). *Bull. Brit. Orn. Club* 12: 20, 21.
- Rothschild (1902). *Bull. Brit. Orn. Club* 12: 55, 76.
- Rothschild (1903). *Bull. Brit. Orn. Club* 13: 41.
- Rothschild (1906). *Bull. Brit. Orn. Club* 16: 111.
- Rothschild (1909). *Bull. Brit. Orn. Club* 25: 7.
- Rothschild (1917). *Bull. Brit. Orn. Club* 38: 3.
- Rothschild (1920). *Bull. Brit. Orn. Club* 40: 67.
- Rothschild & Hartert (1902). *Novit. Zool.* 9: 590.
- Rothschild & Hartert (1903). *Novit. Zool.* 10: 482.
- Rothschild & Hartert (1905). *Novit. Zool.* 12: 250.
- Rothschild & Hartert (1913). *Novit. Zool.* 20: 482.
- Rothschild & Hartert (1915). *Novit. Zool.* 22: 53.
- Rothschild & Hartert (1926). *Bull. Brit. Orn. Club* 46: 53.
- Rudebeck (1957). *South Afr. Animal Life* (Res. Lund Univ. Exped. 1950-1951) 4: 416.
- Rüppell (1835). *Neue Wirbelthiere Fauna Abyssinien*, Wigel: 11, 12, 13.
- Rüppell (1836). *Neue Wirbelthiere Fauna Abyssinien*, Wigel.
- Salomonsen (1936). *Bull. Brit. Orn. Club* 56: 99.
- Salomonsen (1947). *Dan. Orn. Foren. Tidssk.* 41: 217-224.
- Salomonsen (1950). *Dan. Orn. Foren. Tidssk.* 44: 219-226.
- Salvadori (1865). *Atti Soc. Ital. Sci. Nat. Milan* 8: 377. [*Buteo auguralis*]
- Salvadori (1865). *Notizia Storica Lavori Classe Sci. Fis. Mat. R. Accade. Sci. Torino*: 133. [*Gyps africanus*]
- Salvadori (1875). *Ann. Mus. Civ. Genova* 7.
- Salvadori (1877). *Ann. Mus. Civ. Genova* 9: 332, 333.
- Salvadori (1879). *Ann. Mus. Civ. Genova* 14: 250, 251. [*Arborophila rubrirostris*, *Lophura inornata*]
- Salvadori (1879). *Ibis*: 474. [*Accipiter novaehollandiae pallidiceps*]
- Salvadori (1888). *Ann. Mus. Civ. Genova* 26: 541, 542.
- Salvadori (1890). *Mem. Acad. Sci. Torino* (Ser. 2) 40: 147.
- Salvadori (1894). *Ann. Mus. Civ. Genova* 34: 152.
- Salvadori (1895). *Boll. Mus. Zool. Anat. Comp. Univ. Torino* 10(208): 20.
- Salvadori & D'Albertis (1875). *Ann. Mus. Civ. Genova* 7: 805, 807.
- Salvadori & Festa (1900). *Boll. Mus. Zool. Torino* 15(368): 38.
- Salvin (1865). *Proc. Zool. Soc. London* (1864): 586.
- Salvin (1867). *Proc. Zool. Soc. London*: 161.
- Salvin (1872). *Ibis*: 240.
- Salvin (1874). *Ibis*: 325.
- Salvin (1875). *Ibis*: 371.
- Salvin (1876). *Ibis*: 379, 496.
- Salvin (1896). *Bull. Brit. Orn. Club* 6: 5.
- Savigny (1809). *Descr. Egypte Hist. Nat.* 1.
- Say (1823). in: *Long's Exped.* 2: 14.
- Schalow (1884). *Zeitschr. ges. Orn.* 1: 105.
- de Schauensee. See Meyer de Schauensee.
- Schiebel (1934). *Falco* 30: 2-3.
- Schlegel (1843). *Abh. Gebiete Zool. Vergleich. Anat.* 3: 3, 8.
- Schlegel (1851). *Abh. Gebiete Zool. Vergleich. Anat.* 3: 15.
- Schlegel (1862). *Mus. Hist. Nat. Pays-Bas, Rev. Méthod. Crist. Coll.*, livr. 1, Astures: 27, 32.
- Schlegel (1863). *Nederlandsch Tijdschrift Dierkunde* (K. Zool. Genootschap Natura Artis Magistra Amsterdam) 1: 131.
- Schlegel (1866). *Nederlandsch Tijdschrift Dierkunde* (K. Zool. Genootschap Natura Artis Magistra Amsterdam) 3: 80, 261. [*Accipiter francesii bratus*, *Megapodius bernsteini*]
- Schlegel (1866). *Vogels Nederlandsche Indië, Valkvogels*: 26, 41, 64, 78. [*Aviceda subcristata rufa*, *Spilornis rufipunctus sulaensis*, *Accipiter rhodogaster sulaensis*]
- Schlegel (1873). *Mus. Hist. Nat. Pays-Bas, Rev. Coll. Oiseaux Proie*, livr. 10: 43, 62, 135.
- Schlegel (1880). *Notes Leyden Mus.* 2: 91.
- Schlegel & Müller, S. (1841). in: Temminck, *Verh. Nat. Geschiedenis Nederlandsche Overzeesche Bezittingen*, Zool. Aves: 37.
- Slater, P.L. (1858). *Proc. Zool. Soc. London*: 356.
- Slater, P.L. (1859). *Ibis*: 275.
- Slater, P.L. (1860). *Ibis*: 148.
- Slater, P.L. (1861). *Ibis*: 218.
- Slater, P.L. (1863). *Proc. Zool. Soc. London*: 118.
- Slater, P.L. (1864). *Proc. Zool. Soc. London*: 248.
- Slater, P.L. (1865). *Proc. Zool. Soc. London*: 429.
- Slater, P.L. (1866). *Proc. Zool. Soc. London*: 303.
- Slater, P.L. (1883). *Proc. Zool. Soc. London*: 57.
- Slater, P.L. (1885). *Proc. Zool. Soc. London*: 322.
- Slater, P.L. & Salvin (1869). *Proc. Zool. Soc. London*: 132.
- Slater, P.L. & Salvin (1870). *Proc. Zool. Soc. London*: 538, 540.
- Slater, P.L. & Salvin (1876). *Proc. Zool. Soc. London*: 357.
- Slater, P.L. & Salvin (1877). *Proc. Zool. Soc. London*: 18-22.
- Slater, W.L. (1918). *Bull. Brit. Orn. Club* 38: 43, 44, 45. [*Geranospiza caerulescens balzarenis*, *Milvago chimango temucoensis*, *Microstrus plumbeus*]
- Slater, W.L. (1918). *Bull. Brit. Orn. Club* 39: 17. [*Buteo archeri*]
- Slater, W.L. (1919). *Bull. Brit. Orn. Club* 39: 76. [*Leucopernis albicollis costaricensis*]
- Slater, W.L. (1919). *Bull. Brit. Orn. Club* 40: 37, 38, 41. [*Pernis celebensis steerei*, *Spilornis cheela rickeni*, *Spilornis cheela palawanensis*, *Spilornis kinabaluensis*]
- Slater, W.L. (1921). *Bull. Brit. Orn. Club* 41: 134.
- Slater, W.L. (1922). *Bull. Brit. Orn. Club* 42: 72.
- Slater, W.L. (1927). *Bull. Brit. Orn. Club* 48: 51.
- Scopoli (1786). *Deliciae Florae Faunae Insulariae* 2: 93.
- Scott (1890). *Auk* 7: 376.
- Selby (1840). *Cat. Gen. Sub-gen. Types Class Aves*: 2, 3.
- Sennett (1879). *Bull. US Geol. Geogr. Surv. Terr.* 5: 428.
- Seoane (1894). *Examen critico Perdices Europa* (1891): 15, 21.
- Serebrovsky (1926). *J. Orn.* 74: 511, 513, 693, 694, 696.
- Serebrovsky (1929). *J. Orn.* 77: 522.
- Servetsov (1850). *Bull. Soc. Imp. Naturalistes Moscou* 23(3): 234.
- Servetsov (1873). *Izvestia Imp. Obshchestva Ljubitelei Estest. Antrop. Etnogr. Moscow* 8 pt. 2 (1872): 112.
- Servetsov (1875). *Bull. Soc. Imp. Nat. Moscou* 48(3): 207, 208.
- Servetsov (1888). *Nouv. Mém. Soc. Imp. Naturalistes Moscou* 15: 182.
- Sharpe (1873). *Ann. Mag. Nat. Hist.* (Ser. 4) 11: 21, 133, 221.
- Sharpe (1874). *Ann. Mag. Nat. Hist.* 14(4): 373. [*Lophura bulweri*]
- Sharpe (1874). *Cat. Birds Brit. Mus.* 1. [*Accipiter novaehollandiae leucosomus*, *Accipiter fasciatus wallacii*, *Uro-inornis*, *Microhierax*]
- Sharpe (1875). *Proc. Zool. Soc. London*: 73, 337.
- Sharpe (1878). *J. Linn. Soc. London, Zool.* 13: 458.
- Sharpe (1879). *Ibis*: 237, 266.
- Sharpe (1887). *Ibis*: 437.
- Sharpe (1888). in: Gould, *Birds New Guinea* pt. 25. [*Aviceda subcristata himarekii*]
- Sharpe (1888). *Proc. Zool. Soc. London*: 183. [*Accipiter albigularis woodfordi*]
- Sharpe (1890). *Ann. Mag. Nat. Hist.* (Ser. 6) 5: 485.
- Sharpe (1894). *Ibis*: 545.
- Sharpe (1897). *Bull. Brit. Orn. Club* 6: 47.
- Sharpe (1902). *Bull. Brit. Orn. Club* 13: 29.
- Sharpe (1903). *Bull. Brit. Orn. Club* 13: 50.
- Sharpe (1904). *Ibis*: 601.
- Sharpe & Chubb (1906). *Ornis* 13: 133.
- Shaw (1797). *Nat. Misc.* 9: 321.
- Shaw (1798). *Nat. Misc.* 9, pl. 301, 345. [*Gymnogyps californianus*, *Callipepla californica*]
- Shaw (1798). *Nat. Misc.* 10, pl. 353. [*Gallus varius*]
- Shaw & Nodder (1804). *Nat. Misc.* 16.
- Shelley (1874). *Ibis*: 90.

- Siebers (1929). *Treubia* 11: 149.
- Siebers (1930). *Treubia* 7(Suppl.): 239, 243.
- Smith, A. (1829). *South Afr. Commercial Advertiser* 4.
- Smith, A. (1830). *South Afr. Quart. J. (Ser. 1)*: 117, 229-231, 392.
- Smith, A. (1834). *South Afr. Quart. J. (Ser. 2)* 3(2): 48, 280, 283, 285.
- Smith, A. (1836). *Rep. Exped. Explor. Central Africa*: 44, 54, 55.
- Smith, A. (1838). *Illus. Zool. South Africa, Aves*, pl. 11.
- Smith, H. (1829). in: Griffith, *Animal Kingdom* 6: 164.
- Snigirevski (1937). in: Johansen, *Vitrevy* 1: 153.
- Snyder (1938). *Occas. Papers Roy. Ontario Mus., Zool.* 4: 4.
- Spix (1824). *Avium Species Novae Itinere Brasiliam* 1: 2, 12.
- Spix (1825). *Av. Bras.* 2: 59, 60.
- Stegmann (1926). *Compt. Rend. Acad. Sci. USSR, Cl. Phys.-Math.*: 65.
- Stegmann (1929). *Bull. Acad. Sci. USSR, Cl. Sci. Phys.-Math.*: 591.
- Stejneger (1884). *Auk* 1: 226, 369. [*Lagopus lagopus alleni*, *Lagopus mutus nelsoni*]
- Stejneger (1884). *Proc. Biol. Soc. Washington* 2: 98. [*Lagopus mutus ridgwayi*]
- Stejneger (1885). *Bull. US Nat. Mus.* 29: 193.
- Stepanian (1959). *Ornitologija* 2: 78.
- Stephens (1819). in: Shaw (1819). *Gen. Zool.* 9 pt. 2: 298. [Bonasa]
- Stephens (1819). in: Shaw (1819). *Gen. Zool.* 11 pt. 2: 316, 323. [*Francolinus, Francolinus africanus*]
- Storer (1952). *Condor* 54: 288.
- Storer (1962). *Condor* 64: 78.
- Storr (1784). *Alpenreise*: 69.
- Stresemann (1912). *Novit. Zool.* 19: 41.
- Stresemann (1913). *Novit. Zool.* 20: 303-307.
- Stresemann (1922). *J. Orn.* 70: 129, note 2, 408.
- Stresemann (1924). *J. Orn.* 72: 323, note 1431. [*Spizaetus bartelsi*]
- Stresemann (1924). *Orn. Monatsber.* 32: 108. [*Hieraeetus kienieri formosus*]
- Stresemann (1925). *J. Orn.* 73: 323, note 1.
- Stresemann (1932). *Orn. Monatsber.* 40: 78.
- Stresemann (1933). *Orn. Monatsber.* 41: 114.
- Stresemann (1940). *Archiv Naturgeschichte* 9: 171.
- Stuart Baker (1914). *Bull. Brit. Orn. Club* 35: 18.
- Stuart Baker (1919). *Bull. Brit. Orn. Club* 40: 18.
- Stuart Baker (1921). *Bull. Brit. Orn. Club* 41: 101.
- Stuart Baker (1927). *Bull. Brit. Orn. Club* 47: 101, 106.
- Styan (1892). *Bull. Brit. Orn. Club* 1: 6.
- Suckley (1861). *Proc. Acad. Nat. Sci. Philadelphia* (1861): 361.
- Sundevall (1836). *K. Vetenskaps-Acad. Handlingar* (1835): 114.
- Sundevall (1837). *Physiogr. Sällskapets Tidskrift, Lund* 1 pt. 2: 177.
- Sundevall (1845). in: Gaimard (1845). *Voy. Scand. Laponie, Spitzberg et Feroë*, livr. 38.
- Sundevall (1851). *Öfversigt K. Vetenskaps-Akad. Förhandlingar, Stockholm* 7(1850): 109, 131, 132, note 3.
- Sushkin (1900). *Bull. Brit. Orn. Club* 11: 5.
- Sushkin (1926). *Bull. Brit. Orn. Club* 47: 35, 36, 37, 38.
- Sushkin (1927). *Bull. Brit. Orn. Club* 48: 22, 23, 25, 26, 27.
- Sutton & Van Tyne (1935). *Occas. Papers Mus. Zool. Univ. Michigan* 231: 1.
- Swainson (1832). in: Swainson & Richardson, *Fauna Bor-Am.* 2 (1831): 358, 496, 497.
- Swainson (1836). *Nat. Hist. Class. Birds* 1: 300.
- Swainson (1837). *Animals Menageries*: 281, 341. [*Falco sparverius isabellinus*, *Falco sparverius cinnamominus*, *Falco longipennis*, *Falco peregrinus macropus*]
- Swainson (1837). *Birds Western Africa* 1: 104, 107, 109. [*Aviceda cuculoides*, *Falco tinnunculus rufescens*, *Falco chirquera ruficollis*]
- Swainson (1837). *Classif. Birds* 2: 344. [*Philopachus*]
- Swann (1919). *Synop. List. Accipitres*: 15, 43, 44.
- Swann (1920). *Synop. List. Accipitres*: 81, 83, 107, 116.
- Swann (1922). *Synop. Accipitres* ed. 2: 90, 97, 98, 135.
- Swann & Hartert (1923). *Bull. Brit. Orn. Club* 43: 170.
- Swarth (1921). *Condor* 23: 59.
- Swarth (1926). *Univ. Calif. Publ. Zool.* 30: 87.
- Swarth (1931). *Proc. Calif. Acad. Sci.* 20: 4.
- Swinhoe (1863). *Proc. Zool. Soc. London* (1862): 287.
- Swinhoe (1864). *Ibis*: 426.
- Swinhoe (1866). *Ibis*: 304.
- Swinhoe (1870). *Ibis*: 85. [*Spilornis cheela rutherfordi*]
- Swinhoe (1870). *Proc. Zool. Soc. London*: 135. [*Phasianus colchicus decollatus*]
- Swinhoe (1871). *Proc. Zool. Soc. London*: 400.
- Swinhoe (1872). *Proc. Zool. Soc. London*: 550, 552.
- Sykes (1832). *Proc. Com. Sci. Corresp. Zool. Soc. London* pt. 2: 81, 153.
- Taczanowski (1875). *Proc. Zool. Soc. London*: 267.
- Taczanowski (1877). *Proc. Zool. Soc. London*: 746.
- Taczanowski (1886). *Orn. Pérou* 3: 275.
- Taczanowski (1891). *Mém. Acad. Imp. Sci. St.-Petersb. (Ser. 7)* 39 pt. 1: 50.
- Tan & Wu (1981). *Zool. Res* 2(4): 303-305.
- Tarnowski (1893). *Field* 77: 409.
- Taverner (1932). *Ann. Rep. Nat. Mus. Canada*: 87.
- Taverner (1940). *Condor* 42: 160.
- Taylor (1920). *Condor* 22: 146.
- Temminck (1813). *Pig. et Gall.* 2: 87, 246, 363.
- Temminck (1815). *Pig. et Gall.* 3: 335, 408, 732, 723.
- Temminck (1821). *Planches Color*, livr. 8, 11, 16.
- Temminck (1822). *Planches Color*, livr. 19, 20, 21.
- Temminck (1823). *Planches Color*, livr. 34, 35, 38.
- Temminck (1824). *Planches Color*, livr. 45, 51, 53.
- Temminck (1825). *Planches Color*, livr. 55, 56, 59, pl. 328, 329.
- Temminck (1827). *Planches Color*, livr. 74: 437, 438.
- Temminck (1828). *Planches Color*, livr. 76, 78: 461.
- Temminck (1829). *Planches Color*, livr. 81.
- Temminck (1830). *Planches Color*, livr. 82.
- Temminck (1831). *Planches Color*, livr. 88.
- Temminck (1851). *Bijdr. tot de Dierk.* 1: 49.
- Temminck & Schlegel (1844). in: Siebold, *Fauna Japonica, Aves*: 5, 7, 16, 18.
- Temminck & Schlegel (1849). in: Siebold, *Fauna Japonica, Aves*: 103.
- Thayer & Bangs (1905). *Bull. Mus. Comp. Zool.* 46: 94.
- Thayer & Bangs (1914). *Proc. New England Zool. Club* 5: 4.
- Thienemann (1829). *Forstj. Vög. Eur. Abth.* 3: 95.
- Tickell (1833). *J. Asiatic Soc. Bengal* 2: 571.
- Todd (1912). *Ann. Cam. Mus.* 8: 213.
- Todd (1915). *Proc. Biol. Soc. Washington* 28: 82, 170.
- Todd (1916). *Proc. Biol. Soc. Washington* 29: 98.
- Todd (1917). *Proc. Biol. Soc. Washington* 30: 6.
- Todd (1919). *Proc. Biol. Soc. Washington* 32: 116.
- Todd (1932). *Proc. Biol. Soc. Washington* 45: 211, 213, 215.
- Todd (1940). *Auk* 57: 390-397.
- Tristram (1879). *Ibis*: 194.
- Tschudi (1843). *Arch. f. Naturg.* 9: 386, 387.
- Tschudi (1844). *Arch. f. Naturg.* 10: 264, 306.
- Tunstall (1771). *Orn. Brit.*: 1.
- Turner (1882). *Proc. US Nat. Mus.* 5: 227.
- Tweeddale (1878). *Proc. Zool. Soc. London* (1877): 765.
- Twomey (1956). *Ann. Carnegie Mus.* 33: 387.
- Tytler (1865). *Proc. Asiatic Soc. Bengal*: 112.
- Ütall (1939). *Auk* 56: 462.
- Valenciennes (1826). *Dict. Sci. Nat. (éd. Levrault)* (1825) 38: 435, 441, 446.
- Van Tyne & Trautman (1941). *Occ. Pap. Mus. Zool. Univ. Mich.* 439: 4, 5, 6.
- Verreaux, J. (1859). in: Thomson's *Arcana Naturae* 1.
- Verreaux, J. (1862). in: Maillard, *Île Réunion*: 60.
- Verreaux, J. (1867). *Bull. Soc. d'Acclimat.* 4(2): 706.
- Verreaux, J. (1868). *Nouv. Arch. Mus. Paris* 4: 85.
- Verreaux, J. (1869). *Nouv. Arch. Mus. Paris* 5: 33.
- Verreaux, J. & Des Murs (1862). *Ibis*: 212.
- Verreaux, J. & Des Murs (1863). *Proc. Zool. Soc. London*: 62.
- Verreaux, J. & Verreaux, E. (1851). *Rev. Mag. Zool. Paris* 3(2): 515.
- Verreaux, J. & Verreaux, E. (1855). *J. Orn.* 3: 101. [*Accipiter toussenelli*]
- Verreaux, J. & Verreaux, E. (1855). *Rev. Mag. Zool. Paris (Ser. 2)* 7: 350. [*Buteo magnirostris pucherani*]
- Vieillot (1807). *Hist. Nat. Oiseaux Amérique Septentrionale* 1: 42.
- Vieillot (1816). *Analys.* 22, 23, 24, 51, 68. [*Itinina*, *Circetus*, *Harpia*, *Spizaetus*, *Daptrius*, *Daptrius ater*, *Polyborus*, *Odontophorus*]
- Vieillot (1816). *Nouv. Dict. Hist. Nat. (Nouv. éd.)* 4: 465, 477, 481, 482. [*Pandion haliaetus cristatus*, *Circus cinereus*, *Buteo ellipticus leucoccephalus*, *Buteo brachyurus*, *Buteo ulhicaudatus*, *Spizastur melanolencus*]
- Vieillot (1816). *Nouv. Dict. Hist. Nat. (Nouv. éd.)* 5: 259, 260. [*Milvago chimachma*, *Milvago chimango*]
- Vieillot (1817). *Nouv. Dict. Hist. Nat. (Nouv. éd.)* 9: 447. [*Meleagris gallopavo silvestris*]
- Vieillot (1817). *Nouv. Dict. Hist. Nat. (Nouv. éd.)* 10: 322, 323, 325, 329, 341. [*Leptodon cayanensis monachus*, *Accipiter cirrocephalus*, *Accipiter bicolor*, *Geranospiza caerulescens*, *Micrastur ruficollis*, *Micrastur gihicollis*, *Micrastur semitorquatus*]
- Vieillot (1817). *Nouv. Dict. Hist. Nat. (Nouv. éd.)* 14: 237. [*Harpyhaliaetus cornatus*]
- Vieillot (1817). *Nouv. Dict. Hist. Nat. (Nouv. éd.)* 18: 317, 318. [*Rostrhamus sociabilis*, *Herpetotheres*]
- Vieillot (1818). *Nouv. Dict. Hist. Nat. (Nouv. éd.)* 20: 563, 564. [*Elanus leucurus*, *Haliastur sphenurus*, *Elanoides forficatus yelapa*]
- Vieillot (1818). *Nouv. Dict. Hist. Nat. (Nouv. éd.)* 23: 445. [*Circetus cinereus*]
- Vieillot (1818). *Nouv. Dict. Hist. Nat. (Nouv. éd.)* 24: 101. [*Elanoides*]
- Vieillot (1819). *Nouv. Dict. Hist. Nat. (Nouv. éd.)* 32: 57.
- Vieillot (1822). *Galerie Oiseaux* 1 pt. 1: 31, 43. [*Haliastur indus girrenera*, *Chelictinia riocourii*]
- Vieillot (1822). *Mém. Soc. Linnéenne Paris* 2 pt. 1: 152. [*Hieraeetus fuscatus*]
- Vieillot (1823). in: Bonnatte & Vieillot, *Tableau Encycl. Méthod. Trois Règnes Nature, Orn.*, livr. 93: 1273, 1238.
- Vieillot (1825). *Gal. Ois.* 2: 23.
- Vigors (1824). *Zool. J.* 1: 338.
- Vigors (1825). *Zool. J.* 2: 69.
- Vigors (1827). *Zool. J.* 3: 434, 436.
- Vigors (1829). *Zool. J.* 4: 349, 354.
- Vigors (1830). *Zool. J.* 5: 275.
- Vigors (1831). *Proc. Com. Sci. Corresp. Zool. Soc. London* (1830/1831) pt. 1: 24, 96.
- Vigors & Horsfield (1827). *Trans. Linn. Soc. London* 15: 181, 183, 184.
- Vo Quy (1975). *Birds of Vietnam*: 245. Science & Technology Publishing House, Hanoi.
- Voous (1950). *Amsterdam Naturalist* 1: 99.
- Voous (1951). *Treubia* 21: 82.
- Wagler (1830). *Ist. von Oken* 23, col. 1109-1112.
- Wagler (1832). *Ist. von Oken*, col. 227, 278, 1225, 1228, 1229.
- Walden (1872). *Ibis*: 363. [*Spilornis cheela pallidus*]
- Walden (1872). *Proc. Zool. Soc. London* (1871): 627. [*Polihierax insignis*]
- Wallace (1864). *Proc. Zool. Soc. London* (1863): 427.
- Wallace (1868). *Ibis*: 14, 17.
- Warner & Harrell (1955). *Rev. Soc. Mex. Hist. Nat.* 14 (1953): 205.
- Warner & Harrell (1957). *Wilson Bull.* 69.
- Waterhouse (1838). in: Alexander, *Exped. Int. Afr.* 2: 267.
- Weske & Terborgh (1971). *Auk* 88(2): 233-238.
- Wetmore (1914). *Proc. Biol. Soc. Washington* 27: 119.
- Wetmore (1926). *Condor* 28: 46.
- Wetmore (1962). *Smithsonian Misc. Col.* 145(1): 5-7.
- Wetmore (1963). *Smithsonian Misc. Col.* 145(6): 5.
- Wetmore (1964). *Smithsonian Misc. Col.* 146(6): 15.
- Wetmore & Phelps (1943). *J. Washington Acad. Sci.* 33: 142-146.
- Whistler (1936). *J. Bombay Nat. Hist. Soc.* 38: 434.
- Whistler (1937). *Bull. Brit. Orn. Club* 58: 19.
- Whistler (1939). *Bull. Brit. Orn. Club* 59: 76.
- Whistler (1943). *J. Bombay Nat. Hist. Soc.* 44: 208.
- Whistler & Kinnear (1936). *J. Bombay Nat. Hist. Soc.* 38: 686.
- White, C.M. (1968). *Auk* 85: 183.
- White, C.M.N. (1938). *Ibis* 14(2): 763.
- White, C.M.N. (1947). *Bull. Brit. Orn. Club* 67: 72.
- Wied (1820). *Reise Brasilien* 1: 360.
- Wied (1839). *Reise Nord-Amerika* 1: 162.
- Wilson (1811). *Amer. Orn.* 3: 80.
- Wilson (1812). *Amer. Orn.* 5: 116. [*Accipiter striatus velax*]
- Wilson (1812). *Amer. Orn.* 6: 80. [*Accipiter gentilis atricapillus*]
- Witherby & Lönnerberg (1913). *Brinsch Birds* 6: 270.
- Wotzkow (1991). in: Chancellor & Meyburg, *Birds of Prey Bulletin* 4: 271-281.
- Zarudny (1906). *Orn. Monatsber.* 14: 151.
- Zarudny (1908). *Orn. Monatsber.* 16: 28.
- Zarudny (1910). *Orn. Mitt.* 1: 108.
- Zarudny (1911). *Orn. Mitt.* 2: 311.
- Zarudny (1914). *Orn. Mitt.* 5: 55, 59, 267.
- Zarudny & Härms (1913). *Orn. Monatsber.* 21: 53, 54.
- Zarudny & Loudon (1904). *Orn. Jahrb.* 15: 225.
- Zedlitz (1914). *J. Orn.* 62: 133

GENERAL LIST OF REFERENCES

- Abdulali, H. & Grubb, R. (1970). A new race of the Blackcrested Baza, *Aviceda leuphotes* (Dumont), from the Andaman Islands. *J. Bombay Nat. Hist. Soc.* 67: 137-138.
- Abe, E. (1993). Francolins and fire. *World Pheasant Assoc. News* 41: 3-7.
- Abramov, K.G. (1962). [Observations on the Sharp-winged Grouse in the Amur region]. *Ornitologiya* 4: 182-184. In Russian.
- Abramson, L.J. (1967). The Black Hawk (*Buteogallus anthracinus*) in South Florida. *Amer. Birds* 30: 661-662.
- Abreu, R.M., de la Cruz, J., Rams, A. & García, M.E. (1989). Vertebrados del complejo montañoso "La Zoilita". Holguín, Cuba. *Poeyana Inst. Zool. Acad. Cienc. Cub.* 370.
- Abuladze, A. (1994a). Lesser Spotted Eagle in Georgia. In: Meyburg & Chancellor (1994b).
- Abuladze, A. (1994b). Ecology of the Imperial Eagle (*Aquila heliaca*) in Georgia. In: Meyburg & Chancellor (1994b).
- Ackerman, R.A. & Seagrave, R.C. (1987). Modelling heat and gas exchange of buried avian eggs. *J. Exper. Zool. Suppl.* 1: 87-97.
- Ade, B. (1985). African Cuckoo Hawk breeding at Dichwe. *Honeyguide* 31: 169.
- Aebischer, N.J. (1991). Sustainable yields: gamebirds as a harvestable resource. *Gibier Faune Sauvage* 8: 335-351.
- Agafonov, A.V., Rezinko, D.S., Rozkov, A.A. & Semenov, N.M. (1957). [On the ecology of the Steppe Eagle]. *Bjull. Mosk. ob-va ispyt. prirody otd. biol.* 62: 33-41. In Russian.
- Agostini, N. (1992). Spring migration of Honey Buzzards (*Pernis ptilorvus*) at the Straits of Messina in relation to atmospheric conditions. *J. Raptor Res.* 26(2): 93-96.
- Aguilar-Rodriguez, S.H. (1993). First record of dilute plumage in Roadside Hawk. *Buteo magnirostris*. *J. Raptor Res.* 27(1): 49.
- Aguirre, A. (1947). Sooretama. *Bol. Min. Agric., Rio de Janeiro* 36(4-6): 1-52.
- Aguirre, A.C. & Aldrich, A.D. (1983). *Catálogo das Aves do Museu da Fauna*. Primeira parte. Instituto Brasileiro de Desenvolvimento Florestal, Delegacia Estadual do Estado do Rio de Janeiro, Rio de Janeiro.
- Ahlgren, C.G. & Eriksson, M.O.G. (1984). Exposure to mercury and organochlorines of Osprey in southwest Sweden. *Vår Fågelvärld* 43: 299-305.
- Ahmed, A. & Musavi, A.H. (1993). Preliminary ecological studies in 1991 on the White-crested Kalij Pheasant at Rankhet, Kumun Himalayas, Uttar Pradesh, India. Pp. 73-75 in: Jenkins (1993).
- Ahlund, H. & Helander, B. (1975). The food of the Hazel Grouse (*Tetrastes bonasia*) in Sweden. *Viltrevy* 9: 221-240.
- Akande, M. (1977). The biology and domestication of the African Bushfowl *Francolinus bicalcaratus bicalcaratus*. *Int. Congr. Game Biol.* 13: 474-480.
- Åkesson, S. (1991). Secretary Bird *Sagittarius serpentarius* feeding on Marsh Warblers *Acrocephalus palustris* in Tsavo, Kenya. *Scopus* 15: 46-47.
- Aldmov, M.P. (1940). [The colony of the Black Vulture *Aegypius monachus* L. in the nature reserve of the Crimea]. *Trudy Krymskogo gos. zapovednika* 2: 217-227. In Russian.
- Alamany, O. & de Juan, A. (1983). Le Grand Tétras (*Tetrao urugallus*) et le Lagopède (*Lagopus mutus*) dans les Pyrénées orientales ibériques. *Acta Biologica Monkanu* 2(3): 363-381.
- Alaoui, My Y. (1983). Recherches préliminaires sur l'écologie et la reproduction de la Perdrix gambra (*Alectoris barbara*). Symposium sur la gestion de la faune sauvage méditerranéenne. Administration des Eaux et Forêts et Conseil de la Chasse, Morocco.
- Alaoui, My Y. (1985). *Le repeuplement des territoires de chasse à Perdrix gambra* (Alectoris barbara). Imprimatlas S.A., Rabat, Morocco.
- Alaoui, My Y. (1992). Ecology of egg-laying in the Barbary Partridge (*Alectoris barbara*) in Morocco. Pp. 405-415 in: Birkan, Potts et al. (1992).
- Alatalo, R.V., Hoglund, J. & Lundberg, A. (1991). Lekking in the Black Grouse: a test of male viability. *Nature* 352: 155-156.
- Alatalo, R.V., Hoglund, J., Lundberg, A. & Sutherland, W. (1992). Evolution of Black Grouse leks: female preferences benefit males in larger leks. *Behav. Ecol.* 3: 53-59.
- Albers, R.P. & Gehlbach, F.R. (1990). Choices of feeding habitat by relict Monteruma Quail in central Texas. *Wilson Bull.* 102: 300-308.
- Albuquerque, J.L.B. (1978). Contribuição ao conhecimento de *Falco peregrinus* Tunstall, 1771 na America do Sul (Falconidae, Aves). *Rev. Brasil. Biol.* 38: 727-737.
- Albuquerque, J.L.B. (1986). Conservation and status of raptors in southern Brazil. Pp. 88-94 in: Chancellor & Meyburg (1986).
- Albuquerque, J.L.B., Witche, A.J. & Aldous, A.M. (1986). A roadside count of diurnal raptors in Rio Grande do Sul, Brazil. Pp. 82-87 in: Chancellor & Meyburg (1986).
- Alden, P. (1969). *Finding the Birds in Western Mexico*. University of Arizona Press, Tucson, AZ.
- Alderton, D. (1992). *The Atlas of Quails*. T.F.H. Publications, Neptune City, NJ.
- Aldrich, J.W. (1946). The United States races of the Bobwhite. *Auk* 63: 494-508.
- Aldrich, J.W. (1963). Geographic orientation of American Tetraonidae. *J. Wildl. Manage.* 27: 529-545.
- Aldrich, J.W. & Duvall, A.J. (1955). Distribution of American gallinaceous game birds. *Circ. U.S. Fish Wildl. Serv.* 34: 1-23.
- Aldrich, J.W. & Friedmann, H. (1943). A revision of the Ruffed Grouse. *Condor* 45: 85-103.
- Aleixo, A.L.P., de Lima, F.C.T. & Fortalezza, D.M.R. (1991). Resultados de uma excursão ornitológica à Reserva Biológica de Sooretama. Unpublished report to Centro de Preservação dos Psitacídeos de Espírito Santo e Sul Bahia.
- Alexander, B. (1909). New species discovered on the Peak of Cameroon. *Bull. Brit. Orn. Club* 25: 12-13.
- Ali, S. (1962). *The Birds of Sikkim*. Oxford University Press, Delhi.
- Ali, S. (1977). President's letter. "Mystery" birds of India: Mountain Quail. *Hornbill* 1977(3): 3-5.
- Ali, S. (1979). *The Birds of India*. Bombay Natural History Society, Bombay.
- Ali, S. & Ripley, S.D. (1948). The birds of the Mishmis Hills. *J. Bombay Nat. Hist. Soc.* 48: 1-37.
- Ali, S. & Ripley, S.D. (1978). *Handbook of the Birds of India and Pakistan*. Vol. 1. 2nd edition. Oxford University Press, Delhi.
- Ali, S. & Ripley, S.D. (1980). *Handbook of the Birds of India and Pakistan*. Vol. 2. 2nd edition. Oxford University Press, Delhi.
- Allison, R.M. (1976). The history of the Wild Turkey in Ontario. *Can. Field-Nat.* 90(4): 481-485.
- Alkon, P.V. (1979). Gonadal cycles in a population of Chukar Partridge *Alectoris chukar* (Aves: Phasianidae). *Israel J. Zool.* 28: 167-176.
- Altan, D. (1988a). Breeding success, nest spacing and territory size of Black Eagles in the Maglathesberg. South Africa. *Gabor* 3: 76-81.
- Altan, D. (1988b). Raptors nesting on transmission pylons. *Afr. Wildl.* 42: 325-326.
- Altan, D. (1990). Long-tailed Grouse in the Maglathesberg. *Afr. Wildl.* 44: 26-30.
- Altan, D.G. & Huxford, C.W. (1984). The biology of the Oyambo Sparrowhawk (extended abstract). Pp. 57-58 in: *Proceedings 2nd Symposium African Predatory Birds*. Natal Bird Club, Durban.
- Allan, T.A. (1985). Seasonal changes in habitat use by Maine Spruce Grouse. *Can. J. Zool.* 63: 2738-2742.
- Allen, A.A. (1934). Breeding season behaviour of the Ruffed Grouse. *Trans. Amer. Game Conf.* 20: 311-322.
- Allen, F.G.H. (1949). A mating between Changeable Hawk-Eagles in different colour phases. *Malay Nat. J.* 5: 42.
- Allen, G.A. III (1994). The Long-tailed Pheasants. Long-time zoo & aviary favorites. *Game Bird Breeders Conserv. Gaz.* 32(3-4): 8-9, 18-20.
- Allen, G.A. Jr. (1994). Eared-pheasants. Their captive history & propagation. *Game Bird Breeders Conserv. Gaz.* 32(1-2): 11-15.
- Allen, G.A. Jr., Allen, G.A. III & Allen, L. (1977). A new species of curassow discovered. *Game Bird Breeders Conserv. Gaz.* 26(6): 6-7.
- Allen, G.M. (1930). The birds of Liberia. Pp. 636-748 in: *The African Republic of Liberia*. Vol. 5. Contr. Dept. Trop. Med. & Inst. Trop. Biol. Mod. Cambridge, MA.
- Allen, G.T. (1987). Prairie Falcon aerial site characteristics and aerial use in North Dakota. *Condor* 89: 187-190.
- Allen, G.T., Murphy, R.K., Steinhof, K. & Platt, S.W. (1986). Late fledging dates, renealing, and large clutches of Prairie Falcon. *Wilson Bull.* 98: 463-465.
- Allen, R.P. (1962). *Birds of the Caribbean*. Thames and Hudson, London.
- Allouse, B.E. (1953). The avifauna of Iraq. *Iraq Nat. Hist. Mus. Publ.* 3.
- Allport, G. (1991). The status and conservation of threatened birds in the Upper Guinea forest. *Bird Conserv. Int.* 1: 53-74.
- Allport, G., Ausden, M., Hayman, P.V., Robertson, P. & Wood, P. (1989). *The Conservation of the Birds of Gola Forest, Sierra Leone*. ICBP Study Report 38. Cambridge, England.
- Almasan, H. (1970). Beitrag zur Kenntnis der Nahrung des Auerhahns während der Balzzeit. *Zeit. Jagdwiss.* 16: 7-13.
- de Almeida, A.F. (1986). Análise ambiental para determinação de uma unidade de conservação no Pantanal de Mato Grosso. Unpublished report to Dep. Cienc. Florest., USP.
- Alonso, J.C., González, L.M., Heredia, B. & González, J.L. (1987). Parental care and the transition to independence of the Spanish Imperial Eagle (*Aquila adalberti*) in Doñana National Park, SW Spain. *Ibis* 129: 212-234.
- Altenburg, W., Daan, S., Starkenburg, J. & Zijlstra, M.J. (1982). Polygamy in the Marsh Harrier (*Circus aeruginosus*): individual variation in hunting performance and number of mates. *Behaviour* 79: 273-312.
- Altmeyer, M., Dittmann, J., Dmowski, K., Wagner, G. & Müller, P. (1991). Distribution of elements in flight feathers of a White-tailed Eagle. *Science Total Environment* 105: 157-164.
- Alvarez, C.W. & Lorenzo, J.D.L. (1987). Nesting success of the American Kestrel (*Falco sparverius sparverius* Vigors) in the Boas de la Jaula, Tapaste, Yavina Province. Pp. 43-46 in: Bird & Bowman (1987).
- Alvarez del Toro, M. (1952). *Los Animales Silvestres de Chiapas*. Ediciones del Gobierno del Estado, Tuxtla Gutiérrez, Chiapas, Mexico.
- Alvarez del Toro, M. (1976). Datos biológicos del Pavón (*Oreophaps derbianus* G. R. Gray). *Rev. Univ. Auton. Chiapas* 1: 43-54.
- Alvarez del Toro, M. (1981a). Aves notables en Chiapas y problemas para la conservación de la avifauna local. *Centronia* 1(2): 79-88.
- Alvarez del Toro, M. (1981b). Situación actual de los crecidos en Chiapas. Pp. 89-92 in: Estudillo López (1981).
- Alvarez, E. (1993). Synopsis: what we have learned about the Harpy Eagle. *Peregrine Fund News* 23(Winter): 14.
- Alvarez, E. (1994). Harpy Eagles. *Wildbird Magazine* 1: 30-33.
- Alvarez, V.B. & Montiel, J.F. (1984). Genetic polymorphism of the Cuban Sparrow Hawk. *Poeyana Inst. Zool. Acad. Cienc. Cuba* 28(3): 1-11.
- Alway, J.H. & Boag, D.A. (1979). Behaviour of captive Spruce Grouse at the time broods break up and juveniles disperse. *Can. J. Zool.* 57: 1311-1317.
- Amadon, D. (1949). Notes on *Harporhynchus*. *Auk* 66: 53-56.
- Amadon, D. (1950). What is *Spizaeus devallii* Dubois? *Auk* 67: 235-236.
- Amadon, D. (1953). Remarks on the Asiatic Hawk-eagles of the genus *Spizaeus*. *Ibis* 95: 492-500.
- Amadon, D. (1954). On the correct names for the Caracaras and for the Long-winged Harrier. *Auk* 71: 203-204.
- Amadon, D. (1960). Notes on the genus *Chondrohierax*. *Novedades Colombianas* 1(5): 237-238.
- Amadon, D. (1961a). Relationships of the Cincereous Harrier. *Auk* 78: 256-257.
- Amadon, D. (1961b). Relationships of the falconiform genus *Harpagus*. *Condor* 63: 178-179.
- Amadon, D. (1961c). Remarks on the genus *Buteogallus*. *Novedades Colombianas* 1(6): 358-360.
- Amadon, D. (1963). Comparison of fossil and recent species: some difficulties. *Condor* 65(5): 407-409.
- Amadon, D. (1964). Taxonomic notes on birds of prey. *Amer. Mus. Novit.* 2166: 1-24.
- Amadon, D. (1970). [On trachea of Cracidae]. *Nat. Hist. Bull. Siam Soc.* 23: 239-248.
- Amadon, D. (1974). Taxonomic notes on the Serpent-eagles of the genus *Spilornis*. *Bull. Brit. Orn. Club* 94: 159-163.
- Amadon, D. (1978). Remarks on the taxonomy of some Australasian raptors. *Emu* 78: 115-118.
- Amadon, D. (1979). Of curassows and barometers. *Audubon* 81(6): 56-67.
- Amadon, D. (1982a). The genera of booted eagles: *Aquila*, and relatives. *J. Yamashina Inst. Orn.* 14(2-3): 108-121.
- Amadon, D. (1982b). A revision of the sub-buteonine hawks (Accipitridae, Aves). *Amer. Mus. Novit.* 2741: 1-20.
- Amadon, D. (1983). The Everglades Kite. *Florida Field Nat.* 11(4): 69-72.
- Amadon, D. & Bull, J. (1988). Hawks and Owls of the World: A Distributional and Taxonomic List. *Pan. Amer. Found. Vert. Zool.* 3(4): 295-357.
- Ambrosetti, H.T. (1919). Notas sobre algunas rapaces. *Hornbill* 1: 287-290.
- Ames, P.L. (1966). DDT residues in the eggs of the Osprey in the northeastern USA and their relation to nest success. *J. Appl. Ecol.* 3(Suppl.): 87-89.
- Ammann, G.A. (1934). Determining age of Pinnated and Sharp-tailed Grouse. *J. Wildl. Manage.* 8: 170-171.
- Ammann, G.A. (1957). *The Prairie Grouse of Michigan*. Michigan Department of Conservation, Lansing.
- Ammann, G.A. (1963a). Status and management of Sharp-tailed Grouse in Michigan. *J. Wildl. Manage.* 27: 802-809.
- Ammann, G.A. (1963b). Status of Spruce Grouse in Michigan. *J. Wildl. Manage.* 27: 591-593.
- Amores, F. & Franco, A. (1981). [Feeding and ecology of the Short-toed Eagle in southern Spain]. *Alauda* 49: 59-64. In Spanish.
- Anderson, R. (1982). *Barro Colorado Island: Biological and Ecological Studies*. Stanford University Press, Stanford.
- Anderson, J.E. (1986). Habitat selection by Willow Grouse *Lagopus l. lagopus* in central Norway. *Fauna Norvegica (Ser. C. Cinclus)* 9: 82-94.
- Anderson, D.W. & Hickey, J.J. (1972). Eggshell changes in certain North American birds. Pp. 514-540 in: *Proc. XV Int. Orn. Congr., the Hague, 1970*.
- Anderson, J.J.A. (1991). *Reproduction in southern birds*. World Pheasant Assoc. News 42: 6-11.
- Anderson, L.J. (1973). *Habitat Use, Behaviour, Territoriality, and Movements of the Mule Canada Spruce Grouse of Northern Minnesota*. M.S. thesis, University of Minnesota, St. Paul.
- Anderson, R.K. (1969). Prairie chicken responses to changing booming-ground cover type and height. *J. Wildl. Manage.* 33: 636-643.
- Anderson, W. (1978). Vocalizations of Seated Quail. *Condor* 80: 49-63.

- Ando, S. & Ogasawara, A. (1971). Tracking telemetry of a Pheasant *Phasianus colchicus*. *Jap. J. Ecol.* **21**: 32-36.
- Andrade, J., & Franco, A. (1975). Sobre el área de invernada de *Falco naumanni* en España. *Ardeola* **21**: 321-324.
- Andrews, A.V. (1971). [Peculiarities of the ecology of the Rock Ptarmigan *Lagopus mutus* in the Commander Islands]. *Zoologicheskii Zhurnal* **50**: 1260-1262. In Russian.
- Andrews, A.V. (1975a). [On the energetics of the Black-billed Capercaillie during winter feeding period]. *Ekologiya* **6**: 90-92.
- Andrews, A.V. (1975b). [Life during winter and feeding of *Lagopus mutus* in the northeastern extreme of the USSR]. *Zoologicheskii Zhurnal* **54**: 727-733. In Russian.
- Andrews, A.V. (1977a). [Courtship behaviour in Black-billed Capercaillie in northeast Siberia]. *Ornitologiya* **13**: 110-116. In Russian.
- Andrews, A.V. (1977b). [Temperature conditions in the snow hole of the Hazel Hen *Tetrastes bonasia kolyanensis* But.]. *Ekologiya* **5**: 93-95. In Russian.
- Andrews, A.V. (1979). Reproductive behaviour in Black-billed Capercaillie compared to Capercaillie. Pp. 135-139 in Lovel (1979).
- Andrews, A.V. (1980). *Adaptatsii ptic k zimnim usloviyam Subarktika* [Adaptation of Birds to the Winter Conditions in the Subarctic]. Nauka, Moscow. In Russian.
- Andrews, A.V. (1988a). Ecological energetics of Palaearctic Tetraonidae in relation to chemical composition and digestibility of their winter diets. *Crit. J. Zool.* **66**: 1382-1388.
- Andrews, A.V. (1988b). The ten year cycle of the Willow Grouse of Lower Kolyma. *Oecologia* **76**: 261-267.
- Andrews, A.V. (1991a). Winter habitat segregation in the sexually dimorphic Black-billed Capercaillie *Tetrao urugallus*. *Ornis Scandin.* **22**: 287-291.
- Andrews, A.V. (1991b). Winter adaptations in the Willow Ptarmigan. *Arctic* **44**: 106-114.
- Andrews, A.V. & Kreechmar, A.V. (1976). [Radiotelemetric study of microclimate in snow resting places of *Tetrastes bonasia sibiricus*]. *Zoologicheskii Zhurnal* **55**: 1113-1114. In Russian with English summary.
- Andrews, A.V. & Linden, H. (1986). [Winter energetics of the Capercaillie in Lapland]. Pp. 49-70 in: Iliev, V.D. ed (1986) *Aktualnye problemy ornitologii*. Nauka, Moscow. In Russian.
- Andrew, D. (1991). Red Goshawks safe...for now. *Wingspan* **2**: 1-2.
- Andrew, P. (1985). An annotated checklist of the birds of Cibodas-Gunung Gede Nature Reserve. *Kukila* **2**: 10-28.
- Andrew, P. (1992). *The Birds of Indonesia. A Checklist (Peter's Sequence)*. Kukila Checklist 1. Indonesian Ornithological Society, Jakarta.
- Andrew, P. (1993). The birds of Indonesia. Kukila checklist No.1. Additions, corrections and notes - 1. *Kukila* **6**(2): 47-52.
- Andrew, P. & Holmes, D.A. (1990). Sulawesi Bird Report. *Kukila* **5**(1): 4-26.
- Andrews, M.A. (1982). *The Flight of the Condor: A Wildlife Exploration of the Andes*. Collins/British Broadcasting Corporation, London.
- Andrie, R. (1967). [Migration of *Buteo brachyotus*]. *Wilson Bull.* **79**: 163-197.
- Andrie, R.F. (1967a). The Horned Guan in Mexico and Guatemala. *Condor* **69**: 93-109.
- Andrie, R.F. (1967b). Black Chachalaca (*Penelopina nigra*). *Auk* **84**: 169-172.
- Andrie, R.F. (1969a). Biology and conservation of the Horned Guan. *Amer. Phil. Soc. Yb.* **1968**: 276-277.
- Andrie, R.F. (1969b). Quest for the Horned Guan. *Science* **165**(3): 40-43.
- Angelstam, P. (1983). *Population Dynamics of Tetraonids. Especially the Black Grouse Tetrao tetrix L., in Boreal Forests*. PhD thesis, Uppsala University, Uppsala, Sweden.
- Angelstam, P. (1984). Sexual and seasonal differences in mortality of the Black Grouse *Tetrao tetrix* in boreal Sweden. *Ornis Scandin.* **15**: 123-134.
- Angelstam, P. (1985). Factors influencing the distribution and abundance of the Black Grouse. A review. Pp. 401-431 in: Lovel & Hudson (1985).
- Angelstam, P., Jaarola, M. & Nordh, N. (1985). Are female Black Grouse *Tetrao tetrix* territorial? *Ornis Fenn.* **62**: 124-129.
- d'Angieri, A. (1988). WPA Brazil. *World Pheasant Assoc. News* **21**: 20.
- Angus, A. & Wilson, K.J. (1964). Observations on the diet of some game birds and Columbidae in Northern Rhodesia. I: The Helmeted Guineafowl (*Numida meleagris*). *Puku* **2**: 1-9.
- Angus, R.J. (1992). Notes on nesting Black-breasted Buzzards and other raptors in Sturt National Park. *Austr. Birds* **26**: 13-16.
- Anon. (1983). *Bulletin No. 1*. World Working Group on Birds of Prey. Berlin & Paris.
- Anon. (1984). *Hawaiian Hawk Recovery Plan*. US Fish and Wildlife Service, Portland, Oregon.
- Anon. (1986). Een zwart bevallend. *Dieren* **3**(4): 106-108.
- Anon. (1987). *L'Aigle Royal en Europe*. Ed. Maison de la Nature, Briançon.
- Anon. (1988). A study of the northward migration of Grey faced Buzzard-Eagles passing PaKua Mountain in the spring. *Ann. Taipei Wild Bird Soc.* **1988**: 12-18.
- Anon. (1989a). Horned curassow. *World Pheasant Assoc. News* **26**: 20.
- Anon. (1989b). Initial success in connection with research of the Horned Guan. *Flying Free* **7**(1-2): 5-6.
- Anon. (1989c). Rheinart's Crested Argus. *World Pheasant Assoc. News* **24**: 19-21.
- Anon. (1991a). ["Reintroduction" of *Crax flumenbachii* in Curating Reserve (Fazenda Montes Claros) in eastern Minas Gerais]. *Atualidades Ornitológicas* **39**: 1.
- Anon. (1991b). Cracid news from around the world. *Mexico. Cracid Newsl.* **1**(1): 4.
- Anon. (1991c). Harpia. *Vida Silvestre* **23**: 49-50.
- Anon. (1992). *Peregrine Falcon Recovery Program, Status and Recommendations*. The Peregrine Fund, Boise, ID.
- Anon. (1994). Alarming new information on extraordinary new species. *World Birdwatch* **16**(1): 3.
- de Antas, T.Z. & da Silveira, C.L. (1980). Breeding the King Vulture *Sarcoramphus papa* at Rio de Janeiro Zoo. *Int. Zoo Yb.* **20**: 202-204.
- Anthony, A.J. (1976). The Lappet-faced Vultures of the Gonarezhou. *Bokmakier* **28**: 54-57.
- Anthony, A.J., Komen, J. & Mundy, P.J. (1980). Lappet-faced Vultures (*Torgus trachelionus*) hatch and rear a White-headed Vulture (*Trigonoceps occipitalis*) in the wild. *J. Zool., London* **191**: 503-508.
- Anthony, R. (1970). Ecology and reproduction of California Quail in southeastern Washington. *Condor* **72**: 276-287.
- Anthony, R.G., Knight, R., Allen, G., McClelland, B. & Hodges, J. (1982). Habitat use by nesting and roosting Bald Eagles in the Pacific Northwest. *Trans. North Amer. Wildl. Nat. Resour. Conf.* **47**: 332-342.
- Appelman, F.J. (1961). The Congo Peacock. *Avicult. Mag.* **67**: 41-42.
- Arud, Z.L., Midgard, U. & Bernstein, M.H. (1989). Thermoregulation in Turkey Vultures: vascular anatomy, arterio-venous heat exchange and behaviour. *Condor* **91**: 505-514.
- Arujo, J., Muñoz-Cobo, J. & Purroy, F.J. (1977). *Las Rapaces y Aves Marinax del Archipiélago de Cabrera*. Naturalia Hispanica 12. ICONA, Madrid.
- Archer, G. & Godman, E.M. (1937). *The Birds of British Somaliland and the Gulf of Aden*. Vol. 2. Gurney & Godson, London.
- Archibald, H.L. (1973). *Spring Drumming Activity and Space Use of Ruffed Grouse*. PhD thesis, University of Minnesota, Minneapolis.
- Archibald, H.L. (1974). Directional differences in the sound intensity of Ruffed grouse drumming. *Auk* **91**: 517-521.
- Archibald, H.L. (1975). Temporal patterns of spring space use by Ruffed Grouse. *J. Wildl. Manage.* **39**: 472-481.
- Archibald, H.L. (1976a). Spatial relationships of neighboring male Ruffed Grouse in spring. *J. Wildl. Manage.* **40**: 750-760.
- Archibald, H.L. (1976b). Spring drumming patterns of Ruffed Grouse. *Auk* **93**: 808-829.
- Argelou, M. (1992a). The Maleo - more than a symbol. *World Birdwatch* **14**(1): 8-9.
- Argelou, M. (1992b). Problems of Maleo on Sulawesi. *Dutch Birding* **14**: 54-55.
- Argelou, M. (1992c). *Maleo Conservation Project. Phase II*. Mimeographed report, Institute of Taxonomic Zoology, University of Amsterdam.
- Arias de Reyna, L. & Alvarez, F. (1974). Comportamiento de la Perdiz Moruna (*Alectoris barbara*) en cautividad. *Doñana Acta Vertebrata* **1**: 69-82.
- Armleder, H.M. (1980). *Habitat Use and Movements of Hens and Broods in Relation to the Demography of the Blue Grouse*. MSc thesis, University of Toronto, Toronto.
- Armstrong, R.H. (1983). *A New Expanded Guide to the Birds of Alaska*. Alaska Northwest Publishing Company, Anchorage, Alaska.
- Arnold, L.V. (1954). The Golden Eagle and its economic status. *Circ. US Fish Wildl. Serv.* **27**.
- Arnold, P. & Ferguson, W. (1962). *Birds of Israel*. Haifa.
- Arroyo, B. (1991). Resultados del censo nacional de águila perdicera. *Quercus* **70**: 17.
- Arroyo, B., Bueno, J.M. & Pérez-Mellado, V. (1976). Biología de reproducción de una pareja de *Hieracetus fuscatus* en España Central. *Doñana Acta Vertebrata* **3**(1): 33-45.
- Arroyo, B., Ferreira, E. & Garza, V. (1990a). El Águila Real (*Aquila chrysaetos*) en España. *Censo, Distribución, Reproducción y Conservación*. ICONA, Madrid.
- Arroyo, B., Ferreira, E. & Garza, V. (1990b). El Censo Nacional de Buitre Leonado (*Gyps fulvus*): Población, Distribución, Demografía y Conservación. ICONA, Madrid.
- Arroyo, B., Ferreira, E. & Garza, V. (1990c). *Inventario de la Población Española de Águila Perdicera (Hieracetus fuscatus) y sus Áreas de Cría*. ICONA, Madrid.
- Arthaud, F.L. (1968). *Populations and Movements of the Prairie Chicken Related to Land Use in Southwestern Missouri*. MA thesis, University of Missouri, Columbia.
- Arthaud, F.L. (1970). Land use and Prairie Chicken populations in southwestern Missouri. *Trans. Kansas Acad. Sci.* **73**: 267-276.
- Artmann, A. (1990). Successful breeding of the Rufous-headed Chachalaca *Ortalis erythroptera* (Sclater and Salvin, 1870) in the ornithological zoo at Schmiding, Austria. *Avicult. Mag.* **96**: 174-177.
- Artmann, J.W. (1970). *Spring and Summer Ecology of the Sharp-tailed Grouse*. PhD thesis, University of Minnesota, St. Paul.
- Aschenbrenner, H. (1982). Keeping and rearing of grouse in enclosures - problems and experiences. Pp. 212-217 in: Lovel (1982).
- Aschenbrenner, H., Bergmann, H. & Müller, F. (1978). Gefangenschaftsbrut beim Hazelhuhn (*Bonasa bonasia* L.). *Pirsch* **30**: 70-75.
- Ash, A. (1979). *The Effect of Urea Fertilizer on the Habitat, Population Dynamics, and Local Distribution of Blue Grouse*. PhD thesis, University of Toronto, Toronto.
- Ash, J.S. (1978). The undescribed female of Harwood's Francolin *Francolinus harwoodi* and other observations on the species. *Bull. Brit. Orn. Club* **98**: 50-55.
- Ash, J.S. (1990). Additions to the avifauna of Nigeria, with notes on distributional changes and breeding. *Malimbus* **11**(2): 104-116.
- Ash, J.S. (1992). The galliform species of the Horn of Africa (Ethiopia, Somalia and Djibouti). Pp. 539-552 in: Birkan, Potis et al. (1992).
- Ash, J.S. (1993). Raptor migration on Bali, Indonesia. *Forktail* **9**(3): 3-11.
- Ash, J.S. & Gullick, T.E. (1989). The present situation regarding the endemic breeding birds of Ethiopia. *Scopus* **13**: 90-96.
- Ash, J.S. & Miskell, J.E. (1983). *Birds of Somalia. Their Habitats, Status and Distribution*. Scopus Special Supplement 1. 97 pp.
- Askins, C. (1955). Pheasant-Turkey hybrids. *Science* **121**: 307-308.
- Assink, H. (1991). Report on the fourth meeting of Congo Peafowl members. *World Pheasant Assoc. News* **34**: 7-8.
- Assink, J.A. (1993a). The significance of captive breeding for the conservation of Galliformes. Pp. 95-97 in: Jenkins (1993).
- Assink, J.A. (1993b). Captive breeding strategy for the Galliformes. Pp. 98-100 in: Jenkins (1993).
- Attwell, R.I.G. (1963). Some observations on feeding habits, behaviour and inter-relationships of Northern Rhodesian Vultures. *Ostrich* **34**: 235-247.
- Aubin, A.E. (1970). *Territory and Territorial Behaviour of Male Ruffed Grouse in Southwestern Alberta*. MSc thesis, University of Alberta, Edmonton.
- Aubin, A.E. (1972). Aural communication in Ruffed Grouse. *Can. J. Zool.* **50**: 1225-1229.
- Auburn, J. (1987). RSD and the agility of the Bat Hawk. *Gabar* **2**: 15-16.
- Auburn, J. (1988). Why Wahlberg's Eagle is not a *Hieracetus* eagle. *Gabar* **3**: 15-18.
- Auburn, J. (1991). The timing of Wahlberg's Eagles' migrations through Central Africa. *Gabar* **6**: 64-67.
- Audubon, J.J. (1826). Account of the habits of the Turkey Buzzard *Vultur aura* particularly with the view of exploding the opinion generally entertained of its extraordinary powers of smelling. *Edinb. New Phil. J.* **2**: 172-184.
- Ault, S.C. & Stormer, F.A. (1983). Seasonal food selection by Scaled Quail in northwestern Texas. *J. Wildl. Manage.* **47**: 222-228.
- Aumann, T. (1988a). Breeding behaviour of the Brown Goshawk *Accipiter fuscatus*. *Austr. Bird Watcher* **12**: 258-267.
- Aumann, T. (1988b). The diet of the Brown Goshawk *Accipiter fuscatus*. *Austr. Wildl. Res.* **15**: 587-594.
- Aumann, T. (1988c). Foraging behaviour of the Brown Goshawk (*Accipiter fuscatus*) in southeastern Australia. *J. Raptor Res.* **22**: 17-21.
- Aumann, T. (1988d). The morphology of the Brown Goshawk *Accipiter fuscatus*. *Corella* **12**: 33-42.
- Aumann, T. (1989a). Breeding parameters of the Brown Goshawk *Accipiter fuscatus* in south-eastern Australia. *Emu* **89**: 112-118.
- Aumann, T. (1989b). Prey at a Brown Goshawk nest near the You Yangs Range, Victoria. *Austr. Bird Watcher* **13**: 134.
- Aumann, T. (1990a). The use of stones by the Black-breasted Buzzard *Hamirostra melanosternon* to gain access to egg contents for food. *Emu* **90**: 141-144.
- Aumann, T. (1990b). The breeding behaviour of a Brown Goshawk *Accipiter fuscatus* didimus pair. *Austr. Bird Watcher* **13**: 156-163.
- Aumann, T. (1990c). Morphological notes for *Accipiter* species in northern Queensland. *Corella* **14**: 156-160.
- Aumann, T. (1993). Seasonal movements of the Brown Goshawk *Accipiter fuscatus* in Australia. In: Olsen (1993a).
- Aumann, T. & Baker-Gabb, D.J. (1991). *The Ecology and Status of the Red Goshawk in Northern Australia*. RAOU Report 75. Royal Australasian Ornithologists' Union, Melbourne.
- Aurelian, F. (1954). Notes sur deux rapaces du Ruanda. *Ann. Mus. Congo Belg. Zool.* **1**: 16-18.
- Austin, O.L. (1948). *The Birds of Korea*. Bulletin of the Museum of Comparative Zoology **101**. Cambridge, MA.
- Austin, O.L. & Kuroda, N. (1953). *Birds of Japan, Their Status and Distribution*. Bulletin of the Museum of Comparative Zoology **109**: 279-637. Cambridge, MA.
- Austing, G.R. (1964). *The World of the Red-tailed Hawk*. J.B. Lipincott Co., Philadelphia.
- Autenrieth, R.E. (1969). Impact of strip spray on vegetation and Sage Grouse use on summer habitat. *Pmc. West. States Sage Grouse Workshop* **6**: 147-157.
- Autenrieth, R.E. (1981). *Sage Grouse Management in Idaho*. Wildlife Bulletin 9. Idaho Department of Fish and Game.
- Autenrieth, R.E., Molini, W. & Braun, C. (1982). *Sage Grouse Management Practices*. West. States Sage Grouse Comm. Technical Bulletin 1.
- Averin, J.V. (1938). [The Caucasian Black Grouse]. *Trudy Kavkazsk. gos. zapovednika* **1**: 56-86. In Russian.
- Ayeni, J.S.O. (1979). A guineafowl research programme in Nigeria. *Malimbus* **1**(1): 32-35.
- Ayeni, J.S.O. (1980). *The Biology and Utilization of the Helmeted Guineafowl (Numida meleagris galeata Pallas) in Nigeria*. PhD thesis, University of Ibadan, Nigeria.
- Ayeni, J.S.O. (1981). Aspects of the biology of the Helmeted Guineafowl (*Numida meleagris galeata* Pallas) in Nigeria. *J. World Pheasant Assoc.* **6**: 31-39.
- Ayeni, J.S.O. (1983). Home range size, breeding behaviour, and activities of Helmeted Guineafowl *Numida meleagris* in Nigeria. *Malimbus* **5**(1): 37-43.
- Ayeni, J.S.O. (1984). The biology and utilization of the Helmeted Guineafowl (*Numida meleagris galeata* Pallas). I: The habitat and distribution of guineafowl in the Kainji Lake Basin area, Nigeria. *Afr. J. Ecol.* **22**: 1-6.
- Ayeni, J.S.O., Tewe, O.O. & Ajayi, S.S. (1983). Body measurements, egg characteristics and carcass composition of guineafowl. *Trop. Agric. (Trinidad)* **60**: 224-226.
- Babenko, V.G., Mazhulis, D.V., Ostapenko, V.A. & Pererva, V.I. (1988a). [Distribution, number and nesting ecology of Steller's Sea Eagle (*Haliaeetus pelagicus*) on the area of Lower Amur River]. *Arch. Zool. Mus. Moscow State Univ.* **26**: 207-224. In Russian.
- Babenko, V.G., Mazhulis, D.V., Ostapenko, V.A., Pererva, V.I. & Poyarko, N.D. (1988b). [Breeding of the Steller's Sea Eagle in the Low Primorye]. Pp. 132-137 in: Litvinenko (1988). In Russian.
- Baccetti, N. & Spagnesi, M. eds. (1987). *Rapaci Mediterranei III. Atti del Quarto Colloquio Internazionale sui Rapaci Mediterranei*. San'Antonio (Cagliari) 11-13 ottobre 1984. Supplemento alle Ricerche di Biologia della Selvaggina Volume XII. Istituto Nazionale di Biologia della Selvaggina. Bologna, Italy.
- Baccetti, N., Spagnesi, M. & Giannetta, C. (1988). [A White-tailed Sea Eagle *Haliaeetus albicollis*, wintering near Ormezzano (West Central Italy)]. *Riv. Ital. Orn.* **59**(1-2): 105-108. In Italian with English summary.
- Backhurst, G.C. & Pearson, D.J. (1977). Ethiopian Region birds attracted to the lights of Ngula Safari Lodge. *Kenya. Scopus* **1**: 98-103.
- Backhurst, G.C., Britton, P.L. & Mann, C.F. (1973). The less common Palearctic migrant birds of Kenya and Tanzania. *J. East Afr. Nat. Hist. Soc. & Natl. Mus.* **140**: 1-38.
- Badiali, B. (1992). Das Auerhuhn in einem Hochgebirge (1981-1991). *Orn. Rev.* **89**: 50-55.
- Baepler, D.H. (1962). The avifauna of the Soloma Region in Huehuetenango, Guatemala. *Condor* **64**: 140-153.
- Bagraya, J., Haruszky, L. & Szitta, T. (1994a). Methods and results of Saker Falcon *Falco cherrug* management and conservation in Hungary. In: Mesiburg & Chancellor (1994a).
- Bagraya, J., Haruszky, L. & Szitta, T. (1994b). Feeding biology of the Saker Falcon *Falco cherrug* in Hungary. In: Mesiburg & Chancellor (1994a).
- Baha El Din, S. (1984). Notes on the breeding of the Sooty Falcon *Falco concolor* on islands in the Red Sea, and their prey. *Bull. Orn. Soc. Middle East* **12**: 2-3.
- Bailey, E.D. (1983). Influence of incubation calls on post-hatching responses of Pheasant chicks. *Condor* **85**: 43-49.
- Bailey, E.M. (1928). *Birds of New Mexico*. New Mexico Department of Fish and Game, Albuquerque.
- Bailey, R.W. (1955). Notes on albism in the Eastern Wild Turkey. *J. Wildl. Manage.* **19**: 408.
- Bailey, R.W. (1956). Sex determination of adult Wild Turkeys by means of drooping configuration. *J. Wildl. Manage.* **20**: 220.

- Baines, D. (1991). Factors contributing to local and regional variation in Black Grouse breeding success in northern Britain. *Ornis Scand.* 22: 264-269.
- Baines, D., & Linden, H. (1991). Workshop summary: The impact of hunting on grouse population dynamics. *Ornis Scand.* 22: 245-246.
- Baird, S.F. (1867). The origin of the domestic turkey. Pp. 288-290 in: *U.S. Agriculture Report for 1866*.
- Baker, A.J.P., & Whitacre, D.F. (1991). Orange-breasted Falcon reproduction, density and behaviour in northern Central America. *J. Raptor Res.* 27(1): 64.
- Baker, A.J.P., Jenny, J.P., & Whitacre, D.F. (1992). Orange-breasted Falcon reproduction, density, and behaviour in Guatemala and Belize. Pp. 217-224 in: Whitacre & Thorstrom (1992).
- Baker, C.M.A. (1965). Molecular genetics of avian proteins—IV. The egg white proteins of the Golden Pheasant *Chrysolophus pictus* L. and the Lady Amherst's Pheasant *C. amherstiae* Leadbeater, and their possible evolutionary significance. *Comp. Biochem. Physiol.* 16: 93-101.
- Baker, E.C.S. (1920). Note on Siamese pheasants. *J. Nat. Soc. Siam* 3: 47.
- Baker, E.C.S. (1928). *The Fauna of British India, including Ceylon and Burma*. Vol. 5. Birds. Taylor and Francis, London.
- Baker, E.C.S. (1930). *Game Birds of India, Burma and Ceylon*. Vol. 3. John Bale and Son, London.
- Baker, E.C.S. (1935). *The Nidification of Birds of the Indian Empire*. Vol. 1V. Taylor & Francis, London.
- Baker, M.F. (1952). *The Ecology and Management of Prairie Chickens in Kansas*. PhD thesis, University of Kansas, Lawrence.
- Baker, N.E. (1981). Altitude record for Red-necked Spurfowl *Francolinus oler*. *Scopus* 5: 126.
- Baker, R.H. (1951). *The avifauna of Micronesia, its origin, evolution and distribution*. Univ. Kansas Publ. Mus. Nat. Hist. 3(1): 359 pp.
- Baker-Gabb, D.J. (1978). *Aspects of the Biology of the Australasian Harrier Circus aeruginosus approximans*. MSc thesis, Massey University, Palmerston North, New Zealand.
- Baker-Gabb, D.J. (1979). Remarks on the taxonomy of the Australasian Harrier (*Circus approximans*). *Notornis* 26: 325-329.
- Baker-Gabb, D.J. (1981a). Breeding behaviour and ecology of the Australasian Harrier (*Circus approximans*) in the Manawatu-Rangitikei sand country, New Zealand. *Notornis* 28: 241-254.
- Baker-Gabb, D.J. (1981b). The diet of the Australasian Harrier *Circus approximans* in the Manawatu-Rangitikei sand country, New Zealand. *Notornis* 28: 241-254.
- Baker-Gabb, D.J. (1982a). *Comparative Ecology and Behaviour of Swamp Harriers Circus aeruginosus approximans, Spotted Harriers C. assimilis and Other Raptors in Australia and New Zealand*. PhD thesis, Monash University, Melbourne.
- Baker-Gabb, D.J. (1982b). Asynchronous hatching, fratricide and double clutches in the Marsh Harrier. *Corolla* 6: 83-86.
- Baker-Gabb, D.J. (1983). Observations on the mating system and breeding success of the Marsh Harrier in coastal south-eastern Australia. *Corolla* 7: 109-113.
- Baker-Gabb, D.J. (1984a). The feeding ecology and behaviour of seven species of raptor overwintering in coastal Victoria. *Aust. Wildl. Res.* 11: 517-532.
- Baker-Gabb, D.J. (1984b). The breeding ecology of twelve species of diurnal raptor in north-western Victoria. *Aust. Wildl. Res.* 11: 145-160.
- Baker-Gabb, D.J. (1984c). The evolution of tree-nesting and the origin of the Spotted Harrier. *Corolla* 8: 67-69.
- Baker-Gabb, D.J. (1985a). Autumn breeding by the Spotted Harrier *Circus assimilis*. *Aust. Bird Watcher* 11: 48.
- Baker-Gabb, D.J. (1985b). Australasian Harrier *Circus approximans*. Pp. 152-153 in: Robertson (1985).
- Baker-Gabb, D.J. (1985c). Display of the Grey Goshawk *Accipiter novaehollandiae*. *Aust. Bird Watcher* 11: 67.
- Baker-Gabb, D.J. (1985d). Close nesting of Little Eagles *Hieraaetus morphnoides*. *Aust. Bird Watcher* 11: 100.
- Baker-Gabb, D.J. (1985e). Nesting density of Australian Kestrels *Falco cenchroides*. *Aust. Bird Watcher* 11: 66.
- Baker-Gabb, D.J. (1986). Ecological release and behavioural and ecological flexibility in Marsh Harriers on islands. *Emu* 86: 71-81.
- Baker-Gabb, D.J. (1989). Notes on breeding Black Falcons *Falco subniger*. *Aust. Bird Watcher* 13: 101.
- Baker-Gabb, D.J. (1990). Breeding and other behaviour of the Black breasted Buzard *Hamirostra melanosternon*. *Aust. Bird Watcher* 13: 231-235.
- Baker-Gabb, D.J. (1993). Wing tags, winter ranges and movements of Swamp Harriers *Circus aeruginosus approximans* in south-eastern Australia. In: Olsen (1993a).
- Baker-Gabb, D.J., & Fitzherbert, K. (1989). An overview of raptor movements and wintering places in Australia and New Zealand. Pp. 159-166 in: Meyburg & Chancellor (1989).
- Baker-Gabb, D.J., & Pettigrew, J. (1982). Non-breeding diet of the Letter-winged Kite *Elanus scriptus* in north-eastern South Australia. *Corolla* 6: 19-20.
- Balkke, E.L. (1980). *Movements and Habitat Use of Ruffed Grouse in the Turtle Mountains, North Dakota*. Thesis, University of North Dakota, Grand Forks.
- Balat, F., & Gonzalez, H. (1982). Concrete data on the breeding of Cuban birds. *Acta. Sci. Nat. Brno* 16(8): 1-46.
- Baldia, W. (1989). *Evaluation of Success of Plain Chachalaca (Ortalis vetula) Transplants in South Texas*. MSc thesis, N.M. State University.
- van Balen, B. (1992). Distribution, status and conservation of the forest partridges in the Greater Sundas (Indonesia) with special reference to the Chestnut-bellied Partridge (*Arborophila javanica*). Pp. 561-569 in: Birkan, Potts et al (1992).
- van Balen, B., Suwelo, I.S., Hadi, D.S., Soepomo, D., Marlion, R., & Mutiariina. (1993). The decline of the Brahmany Kite *Haliastur indus* in Java. *Forktail* 8: 83-88.
- van Balen, S. (1991). The Java Hawk Eagle *Spizarcus bartelsi*. WWGBP project report No. 1. March 1990 Pp. 33-39 in: Chancellor & Meyburg (1991).
- van Balen, S., & Compost, A.R. (1989). Overlooked evidence of the Short-toed Eagle *Circus gallicus* in Java. *Kukila* 4(1-2): 44-46.
- van Balen, S., & Holmes, D.A. (1993). Status and conservation of pheasants in the Greater and Lesser Sundas, Indonesia. Pp. 40-49 in: Jenkins (1993).
- van Balen, S., & Meyburg, B.U. (1994). The Java Hawk Eagle *Spizarcus bartelsi*: Results of recent research on distribution, status and ecology. In: Meyburg & Chancellor (1994a).
- van Balen, S., Indrawan, M., Setiawan, I., & Setiadi, A. (1993). Conservation of Green Peafowl in Java. Page 141 in: Jenkins (1993).
- Balfour, E. (1957). Observations on the breeding biology of the Hen Harrier in Orkney. *Bird Notes* 27: 117-183.
- Balfour, E., & Cadbury, C.J. (1979). Polygyny, spacing and sex ratio among Hen Harriers *Circus cyaneus* in Orkney, Scotland. *Ornis Scand.* 10: 133-141.
- Balfour, E., & Macdonald, M. (1970). Food and feeding behaviour of the Hen Harrier in Orkney. *Scottish Birds* 1970: 157-166.
- Balgooyen, T.G. (1976). Behaviour and ecology of the American Kestrel (*Falco sparverius*) in the Sierra Nevada of California. *Univ. Calif. Publ. Zool.* 103: 1-83.
- Balgooyen, T.G. (1989). Natural History of the American Kestrel in Venezuela. *J. Raptor Res.* 23: 85-93.
- Ballance, T.C. (1981). Observations on Bat Hawk hunting. *Hedgeguide* 106: 29-30.
- Ballard, W.B., & Robel, R.J. (1974). Reproductive importance of dominant male Greater Prairie Chickens. *Auk* 91: 75-85.
- Balouet, J.C., & Olson, S.L. (1989). Fossil birds from late Quaternary deposits in New Caledonia. *Smithsonian Contrib. Zool.* 469.
- Baltin, S. (1969). Zur Biologie und Ethologie des Talegalla-Huhns (*Alectura lathami* Gray) unter besonderer Berücksichtigung des Verhaltens während der Brutperiode. *Z. Tierpsychol.* 26: 524-572.
- Baltzer, M.C. (1990). A report on the wetland avifauna of South Sulawesi. *Kukila* 5(1): 27-55.
- Bang, B.G. (1972). The nasal organs of the Black and Turkey Vultures: a comparative study of the Cathartid species *Coragyps atratus atratus* and *Cathartes aura sepienrinalis* (with notes on *Cathartes aura falklandica*, *Pseudogyps bengalensis* and *Neophron perenopterus*). *J. Morph.* 115: 153-184.
- Banko, W.E. (1980). *History of Endemic Hawaiian Birds, Part I. Forest Birds: Hawaiian Hawk 'Io*. CPSU/UH Avian History Report 6A. Department of Botany, University of Hawaii, 85pp.
- Banks, J. (1974). Record of the nesting of a pair of Ceylon Shikras (*Accipiter badius badius*) at Galapitakande, Nampunukula (alt. 3,500 ft.) in the Uva Hills, Ceylon. Unpublished notes, Transvaal Museum.
- Banks, R.C. (1987). Taxonomic notes on Singing Quail (Genus *Dactylortyx*) from western and southern Mexico. *Oce. Pac. West. Frond. Vert. Zool.* 4.
- Banks, R.C. (1990). Taxonomic Status of the Rufous-bellied Chachalaca (*Ortalis wagleri*). *Corolla* 92: 749-753.
- Banks, R.C. (1993). The generic name of the Crested Argus *Rheinardia ocellata*. *Forktail* 8: 3-6.
- Banks, R.C., & Dove, C.J. (1992). The generic name for Crested Caracaras (Aves: Falconidae). *Proc. Biol. Soc. Washington* 105(3): 420-425.
- Bannerman, D.A. (1915). A report on the birds collected by the late Mr Boyd Alexander (Rifle Brigade) during his last expedition to Africa. Part IV, the birds of Cameron Mountain. *This Ser.* 10, no. 3: 473-526.
- Bannerman, D.A. (1935). *The Birds of British West Africa*. Vol. 1. Crown Agents for the Colonies, London.
- Bannerman, D.A. (1935). *The Birds of Tropical West Africa*. Vol. 2. Crown Agents for the Colonies, London.
- Bannerman, D.A. (1953). *The Birds of West and Equatorial Africa*. Vols 1-2. Oliver & Boyd, Edinburgh.
- Bannerman, D.A. (1963). *The Birds of the Atlantic Islands*. Vol. 1. Oliver & Boyd, Edinburgh.
- Bannerman, D.A., & Bannerman, W.M. (1965). *Birds of the Atlantic Islands*. Vol. 2. Oliver & Boyd, Edinburgh.
- Bannerman, D.A., & Bannerman, W.M. (1966). *Birds of the Atlantic Islands*. Vol. 3. Oliver & Boyd, Edinburgh.
- Bannerman, D.A., & Bannerman, W.M. (1971). *Handbook of the Birds of Cyprus and the Migrants of the Middle East*. Oliver & Boyd, Edinburgh.
- Bannikov, A.G. ed. (1978). *Red Data Book of the USSR*. Lesnaya Promyshlennost, Moscow. In Russian.
- Banzhaf, W. (1938). *Naturdenkmäler aus Pommerns Vogelwelt*. II. Der Fischadler, der Schreiadler, der Uhu. *Dohrniana* 17: 74-84.
- Baranchew, L.M. (1965). [Migrations of Manchurian pheasants to the Amur region]. Pp. 125-32 in *Migrations of Birds and Mammals*. Nauka, Moscow. In Russian.
- Barnes, H.S. (1991). *Swimming Behaviour, Distribution, and Habitat Selection of Sage Grouse in Utah*. MSc thesis, Brigham Young University, Provo, Utah.
- Barclay, H.J., & Bergerud, A.T. (1975). Demography and behavioural ecology of California Quail on Vancouver Island. *Condor* 77: 315-323.
- Barichello, N. (1983). *Selection of Nest Sites by Gyrfalcons (Falco rusticolus)*. MSc thesis, University of British Columbia, Vancouver.
- Barnard, P. (1986). Windhovering patterns of three African raptors in montane conditions. *Ardea* 74: 151-158.
- Barnard, P., & Simons, R. (1985). Birds of prey of Giant's Castle Game Reserve. *Bokmakierie* 37: 104-107.
- Barnard, P.E. (1982). *Foraging Behaviour and Energetics of Breeding Northern Harriers Circus cyaneus (L.)*. Honors Thesis, Acadia University, Nova Scotia.
- Barnes, E. (1993). Lesser Kestrel (183) in Cape Peninsula. *Praireraps* 207: 1-11.
- Barnes, K.W. (1970). *Behavior of Ruffed Grouse During the Breeding and Early Brood Rearing Periods*. PhD thesis, University of Minnesota, Minneapolis.
- Barros, R. (1967). Notas sobre el tuqueo cordillerano y el águila. *Revista Universitaria (Chile)* 52: 105-112.
- Bartels, H. (1952). *Macheiramphus a. alcinus* Western. Waarnemingen bij vogel, nest en ei. *Limosa* 25: 93-100.
- Bartholomew, G.A., & Dawson, W.R. (1958). Body temperature in California and Gambel's Quail. *Auk* 75: 150-156.
- Bartholomew, G.A., & MacMillen, R.E. (1961). Water economy of the California Quail and its use of seawater. *Auk* 78: 505-514.
- Barton, N.W.H., & Houston, D.C. (1993). A comparison of digestive efficiency in birds of prey. *Ibis* 135(4): 363-371.
- Batambwa, A.M. (1989). The ecology of raptors in and around the Impenetrable Forest, south western Uganda. *Gabur* 4: 14-17.
- Bates, G.L. (1930). *Handbook of the Birds of West Africa*. John Bale, Sons and Danielsson Ltd, London.
- Bates, G.L. (1939). On *Gypaetus barbatus* in Yaman, with wing measurements of the specimens from various countries. *Ibis Ser.* 14: 146-148.
- Bates, R.S.P., & Lowther, E.H.N. (1952). *Breeding Birds of Kashmir*. Oxford University Press, Bombay.
- Bateson, P. ed. (1983). *Mate Choice*. Cambridge University Press, Cambridge.
- Batson, P.P.G., & Nisbet, (1961). Autumn migration in Greece. *This* 103: 503-514.
- Bauer, C.A. (1985). Effects of paraquat on reproduction and growth on Northern Bobwhite. *J. Wildl. Manage.* 49: 1066-1073.
- Bauer, K. (1960). Variabilität und Rassengliederung des Haselhuhns (*Tetrastix himasia*) in Mitteleuropa. *Bonn. zool. Beitr.* 1: 1-18.
- Bauer, K.D. (1962). *Ecology of Blue Grouse on Summer Range in Northcentral Washington*. MSc thesis, Washington State University, Pullman.
- Baumgart, W. (1974). Wie steht es um Europas Geier? *Falke* 8: 259-267.
- Baumgart, W. (1979). Der Pendelflug des Schreiadlers (*Aquila pomarina* Brehm). *Wiss. Hefte d. Päd. Hochschule Kötten* 1: 217-224.
- Baumgart, W. (1980). Steht der Schreiadler unter Zeitdruck? *Falke* 27: 6-17.
- Baumgart, W. (1981). Die Kadaver verwertenden Vögel zentralmongolischer Steppen. *Falke* 28: 366-371.
- Baumgart, W. (1991a). [The vultures of Bulgaria: A. *Neophron perenopterus*]. *Beitr. Vogelkd.* 37(1-2): 1-48. In German with English summary.
- Baumgart, W. (1991b). *Der Sakerfalke*. Neue Brehm-Bücherei 514. A. Ziemsen Verlag, Wittenberg Lutherstadt.
- Baumgart, W. (1994). Die Bestandssituation des Schreiadlers *Aquila pomarina* und Probleme ihrer Ermittlung in Bulgarien. In: Meyburg & Chancellor (1994b).
- Bavoux, C., Burneleau, G., Nicolau-Guillaumet, P., & Picard, M. (1992). [The Marsh Harrier *Circus aeruginosus aeruginosus* in Charente-Maritime (France). V. Movements and daily activities of juveniles in winter]. *Alauda* 60(3): 149-158. In French with English summary.
- Baziev, Zh.Kh. (1965). *Узоры Кабарды: сны, предания, легенды, песни, сказки, приметы, поверья, загадки*. (Caucasian Snowcock as an Example of the Adaptation of Birds to Life in High Mountain). Avtoref. Kand. Diss., Moscow.
- Baziev, Zh.Kh. (1966). Lin'ka Kavkazskogo alau. [Molt in Caucasian Snowcocks]. *Zoologicheskii Zhurnal* 45(1): 1-10.
- Baziev, Zh.Kh. (1968). Migratsii odel'nykh populyatsii kavkazskogo alau (*Tetrao gallicus caucasicus* Pall.) i interpretatsiya ikh proiskhozhdeniya. [Migrations of some populations of Caucasian Snowcocks (*Tetrao gallicus caucasicus* Pall.) and an interpretation of their origins]. *Zoologicheskii Zhurnal* 47(1): 1-10.
- Baziev, Zh.Kh. (1972). Evolution of the genus *Tetrao gallicus* Gray 1834. *Acta Orn. Warszawa* 13(5): 173-90.
- Baziev, Zh.Kh. (1978). *The Snowcocks of the Caucasus. Ecology, Morphology, Evolution*. Nauka, Leningrad.
- Bazulin, S.V. (1990). [Replacement of the downy plumage in the chicks of the Osprey and Greater Spotted Eagle. Fauna and ecology of animals]. *Tver*: 44-48. In Russian.
- Beam, M., & Porter, R.F. (1985). Status of birds of prey in Turkey. Pp. 52-56 in: *World Working Group on Birds of Prey Bulletin No. 2*. World Working Group on Birds of Prey and Owls, Berlin, Paris & London.
- Beani, L., & Dessi-Fulgheri, F. (1986). Gregarious behaviour in a group of captive Grey Partridges *Pendix pendix*. *Bull. Zool.* 53: 69-72.
- Beani, L., Cervo, R., & Dessi-Fulgheri, F. (1988). Influence of mate choice on reproductive success of captive Grey Partridges *Pendix pendix*. Pp. 729-742 in: Birkan, Potts et al. (1992).
- Beani, L., Cervo, R., Lodi, L., Lupo, C., & Dessi-Fulgheri, F. (1988). Circulating levels of sex steroids and socio-sexual behaviour in the Grey Partridge *Pendix pendix* L. *Monitore zool. ital. (N.S.)* 22: 145-160.
- Beason, S.L. (1970). Turkey productivity in two vegetative communities in south Texas. *J. Wildl. Manage.* 34(1): 166-175.
- Beason, S.L., & Pattee, O.H. (1978). Utilization of snails by Rio Grande Turkey hens. *J. Wildl. Manage.* 42(4): 916-919.
- Beaudette, P.D., & Keppie, D.M. (1992). Survival of dispersing Blue Grouse. *Can. J. Zool.* 70: 693-697.
- Beauvais, G., Enderson, J.H., & Margo, A.J. (1992). Home range, habitat use and behavior of Prairie Falcons wintering in east-central Colorado. *J. Raptor Res.* 26: 13-18.
- Bechard, M.J. (1982). Effects of vegetative cover on foraging site selection by Swainson's Hawk. *Condor* 84: 153-159.
- Bechard, M.J. (1988). Food supply and the occurrence of brood reductions in Swainson's Hawk. *Wilson Bull.* 95: 233-242.
- Bechard, M.J., Knight, R.L., Smith, D.G., & Fitzer, R.E. (1990). Nest site and habitats of sympatric hawks (*Buteo swainsoni* in Washington. *J. Field Orn.* 61: 159-170.
- Bechard, M.J., Zoellick, B.W., & Nickerson, M. (1985). Accuracy in determining the age of nestling Red-tailed Hawks. *J. Wildl. Manage.* 49: 226-228.
- Bechinger, F. (1964). Beobachtungen am Weibchuh-Waldhuhn (*Agelastes meleagrides*) im Freileben und in der Gefangenschaft. *Geflügelwelt* 88: 61-62.
- Beck, B.B., Engen, C.W., & Gelfand, P.W. (1973). Behavior and activity of Gambel's Quail and raptorial birds at the Sonoran Desert waterhole. *Condor* 75: 766-770.
- Beck, L.D. (1975). *Autumn and Winter Migration of Sage Grouse*. North Park, Colorado. MSc thesis, Colorado State University, Fort Collins.
- Beck, T.D.J. (1977). Sage Grouse flock characteristics and habitat selection in winter. *J. Wildl. Manage.* 41: 18-26.
- Beck, T.D.J., & Braun, C.E. (1978). Weights of Colorado Sage Grouse. *Condor* 80: 241-243.
- Becker, D.M., & Sieg, C.H. (1965). *Autumn, wintering, and migration of sage grouse in the Rocky Mountains of south-eastern Montana*. *J. Raptor Res.* 19: 52-55.
- Bedgood, G.W. (1979). Field notes on the Black Falcon. *Aust. Bird Watcher* 8: 31-34.
- Bednarek, M. (1993). Captured, released, and then? A method of releasing the birds of raptorial species. *Falco cinereus cinereus*. Pp. 207-212 in: Nicholls & Clarke (1994).
- Bednarek, J.C. (1996). *On the Biology and Ecology of the Common Raven (Corvus corax)*. MSc thesis, University of New Mexico.
- Bednarz, J.C. (1993). Pair and group reproductive success, territory and cooperative breeding in Harris Hawks. *Auk* 104(3): 393-404.

- Bednarz, J.C. (1987b). Successive nesting and autumnal breeding in Harris' Hawks. *Auk* **104**(1): 85-96.
- Bednarz, J.C. (1988a). A comparative study of the breeding ecology of Harris' and Swainson's Hawks in southeastern New Mexico. *Condor* **90**(2): 311-323.
- Bednarz, J.C. (1988b). Cooperative hunting in Harris' Hawks (*Parabuteo unicinctus*). *Science* **239**: 1525-1527.
- Bednarz, J.C., & Dinsmore, J.K. (1981). Status, habitat use, and management of Red-shouldered Hawks in Iowa. *J. Wildl. Manage.* **45**: 36-241.
- Bednarz, J.C., & Ligon, J.D. (1988). A study of the ecological bases of cooperative breeding in the Harris' Hawk. *Ecology* **69**(4): 1176-1187.
- Bednarz, J.C., Klem, D., Goodrich, L.J., & Senner, S.E. (1990). Migration counts of raptors at Hawk Mountain, Pennsylvania, as indicators of population trends, 1934-1986. *Auk* **107**: 96-109.
- Beebe, C.W. (1914a). Preliminary pheasant studies. *Zoologica* **1**(15): 261-85.
- Beebe, C.W. (1914b). Revision of the genus *Gemauus*. *Zoologica* **1** (17): 303-23.
- Beebe, E.L. (1960). The marine Peregrines of the northwest Pacific Coast. *Condor* **62**: 154-189.
- Beebe, W. (1918-1922). *A Monograph of the Pheasants*. 4 Vols. Witherby, London. (Reprinted by Dover Press in 2 vols in 1990)
- Beebe, W. (1936). *Pheasants, Their Live and Homes*. 2nd edition, Robert Hales Ltd, London.
- Beebe, W. (1947). Rare and beautiful *Aburria*. *Animal Kingdom* **47**.
- Beebe, W. (1950). Home life of the Bat Falcon, *Falco albigularis albigularis* Daudin. *Zoologica* **35**: 69-86.
- Becher, B.M. (1978). *Upland Birds of Northeastern New Guinea*. Wau Ecology Institute Handbook 4. Wau, Papua New Guinea.
- Becher, B.M. (1985). Conservation of New Guinea rainforest birds. Pp. 233-247 in: Diamond & Lovejoy (1985).
- Becher, B.M., Crill, W., Jeffries, B., & Jeffries, M. (1992). New Guinea Harpy-Eagle attempts to capture a monitor lizard. *Emu* **92**: 246-247.
- Becher, B.M., Pratt, T.K., & Zimmerman, D.A. (1986). *Birds of New Guinea*. Princeton University Press, Princeton, New Jersey.
- Beer, J. (1943). Food habits of the Blue Grouse. *J. Wildl. Manage.* **7**: 32-44.
- Beer, J.V. (1990). Gamebird diseases in Great Britain. Pp. 265-274 in: Hill et al. (1990).
- Beer, J.V., & Cox, C. (1980). The production of eggs of the Cheer Pheasant *Catreus wallichii* for re-introduction programmes. Pp. 68-71 in: Savage (1980).
- Bege, L.A., do Rosário & Martner, B.T. Pauli (1991). *Conservação da Avifauna na Região Sul do Estado de Santa Catarina, Brasil*. Fundação do Meio Ambiente - FATMA, Florianópolis, Brazil.
- Belik, W. (1927). Die Eier von *Tetrastus severzovi* Presz. *Orn. Monatsber.* **35**: 176-177.
- Beissinger, S.R. (1983). Hunting behaviour, prey selection and energetics of Snail Kites in Guyana: consumer choice by a specialist. *Auk* **100**(1): 84-92.
- Beissinger, S.R. (1984). *Mate Desertion and Reproductive Effort in the Snail Kite*. PhD dissertation, University of Michigan, Ann Arbor.
- Beissinger, S.R. (1986). Demography, environmental uncertainty, and the evolution of mate desertion in the Snail Kite. *Ecology* **67**(6): 1445-1459.
- Beissinger, S.R. (1987a). Anisogamy overcome: female strategies in Snail Kites. *Amer. Naturalist* **129**: 486-500.
- Beissinger, S.R. (1987b). Mate desertion and reproductive effort in the Snail Kite. *Anim. Behav.* **35**(5): 1504-1519.
- Beissinger, S.R. (1990a). Alternative foods of a diet specialist, the Snail Kite. *Auk* **107**(2): 327-333.
- Beissinger, S.R. (1990b). Experimental brood manipulations and the monoparental threshold in Snail Kites. *Amer. Naturalist* **136**(1): 20-38.
- Beissinger, S.R., & Snyder, N.F.R. (1987). Mate desertion in the Snail Kite. *Anim. Behav.* **35**(2): 477-487.
- Beissinger, S.R., & Takekawa, J.E. (1983). Habitat use by and dispersal of Snail Kites in Florida during drought conditions. *Florida Field Nat.* **11**: 89-106.
- Beissinger, S.R., Sprunt, A., & Chandler, R. (1983). Notes on the Snail (Everglades) Kite in Cuba. *Amer. Birds* **37**: 262-265.
- Beissinger, S.R., Thomas, B.T., & Strahl, S.D. (1988). Vocalizations, food habits, and nesting biology of the Slender-billed Kite, with comparisons to the Snail Kite. *Wilson Bull.* **100**(4): 604-616.
- Beklova, M., & Pikula, J. (1983). The ecological, quantitative distribution of *Buteo buteo* in Czechoslovakia. *Folia Zoologica* **37**(3): 241-254.
- Belehr, C., & Smooker, G.D. (1934-1937). Birds of the colony of Trinidad and Tobago. *Ibis Ser. 13* no. 4: 572-595; Ser. 13 no. 5: 279-297; Ser. 13 no. 6: 1-35; 792-813; Ser. 14 no. 1: 225-249; 504-550.
- Belehr, W.J., & Sihson, R.B. (1972). *Birds of Fiji in Colour*. Collins, London.
- Belik, V. (1984). [The breeding life of the Bearded Vulture on Western Caucasus]. *Bull. MOIP (Biol.)* **89**(4): 86-94. In Russian with English summary.
- Belik, V. (1985). [The comparative ecology of the Bearded Vulture and Griffon Vulture]. Pp. 53-71 in: [Birds of the NW Caucasus]. Moscow, In Russian.
- Belik, V. (1986a). [The Levant Sparrowhawk in the Don Basin]. Pp. 128-143 in: [Actual Problems of Ornithology]. Nauka, Moscow. In Russian.
- Belik, V. (1986b). [Ecology of the Caucasian Black Grouse]. Pp. 166-309 in: [The Ornithological Researches on the NW Caucasus]. Stavropol. In Russian.
- Belik, V. (1988). The White-tailed Eagle. *Privody* **5**: 57-59.
- Belik, V. (1990). [The Bearded Vulture in Caucasian reservation]. In: [The Rare, not Numerous and Little Known Birds of the Northern Caucasus]. Stavropol.
- Belik, V. (1992). The Levant Sparrowhawk *Accipiter brevipes* within the former USSR. In: Meyburg & Chancellor (1994a).
- Belik, V. (1993). [The White-tailed Eagle in the Severskiy Donetz basin]. Pp. 40-42 in: [Birds of the Severskiy Donetz basin]. Donetsk. In Russian.
- Bell, D.A. (1990). Successful nesting of Shaheen Falcon (*Falco peregrinus peregrinator*) in Tamil Nadu. *J. Bombay Nat. Hist. Soc.* **87**: 291-292.
- Bell, H.L. (1971). Field notes on birds of Mt Albert Edward, Papua. *Emu* **71**: 13-19.
- Bell, H.L. (1984). New or confirmatory information on some species of New Guinean birds. *Austr. Bird Watcher* **10**: 209-228.
- Bell, H.L. (1985). Distribution and habits of kites, *Milvus migrans*, *Haliastur sphenurus* and *H. indus* in Papua New Guinea. *Condor* **9**: 37-48.
- Bell, P.T., & Summers, A.B. (1982). The ecology of the Chukar (*Alectoris chukar*) and the Black Francolin (*Francolinus francolinus*) in north-west Cyprus. *Ann. Rep. Cyprus Orn. Soc.* **29**: 67-79.
- Beltman, R.H.R., & de Boer, L.E.M. (1990). A miscellaneous collection of bird karyotypes. *Genetica, Dordrecht* **83**(1): 17-30.
- Beltman, W. (1984). *Birds of Rio Grande do Sul, Brazil*. Part 1. Rheidae through Fumariidae. Bulletin of the American Museum of Natural History **178**(4).
- Beltzer, A.H. (1990a). Biología alimentaria del Gavián Común *Buteo magnirostris saturatus* (Aves: Accipitridae) en el valle aluvial del Río Paraná medio, Argentina. *Ornitol. Neotrop.* **11**(2-3): 3-8.
- Beltzer, A.H. (1990b). Biología alimentaria del Halcón Común *Falco sparverius* en el valle aluvial del Río Paraná medio, Argentina. *Humens* **13**: 133-136.
- van Bemmeli, A.C. (1961). L'élevage en captivité du Paon congolais (*Afropavo congensis* Chapin) à l'initiative de notre Société. *Zoo Antwerp* **26**: 94-99.
- van Bemmeli, A.C.V., & Voous, K.H. (1951). On the birds of the islands of Muna and Buton, SE Celebes. *Treubia* **21**: 80-81.
- Bendall, J.F. (1954). *A Study of the Life History and Population Dynamics of the Sooty Grouse Dendragapus obscurus fuliginosus* (Ridgw.) thesis, University of British Columbia, Vancouver.
- Bendall, J.F. (1955a). Age, breeding behavior, and migration of Sooty Grouse, *Dendragapus obscurus fuliginosus* (Ridgw.). *Trans. North Amer. Wildl. Nat. Resour. Conf.* **20**: 367-381.
- Bendall, J.F. (1955b). Age, molt, and weight characteristics of Blue Grouse. *Condor* **57**: 354-361.
- Bendall, J.F. (1972). Population dynamics and ecology of the Tetraonidae. Pp. 81-89 in: *Proc. XV Int. Orn. Congr., the Hague*, 1970.
- Bendall, J.F., & Elliott, P.W. (1966). Habitat selection in the Blue Grouse. *Condor* **68**: 431-446.
- Bendall, J.F., & Elliott, P.W. (1967). *Behavior and the Regulation of Numbers in Blue Grouse*. Canadian Wildlife Service Report Series 4.
- Bendall, J.F., & Zwickel, E.C. (1985). A survey of the biology, ecology, abundance, and distribution of the Blue Grouse (Genus *Dendragapus*). Pp. 163-190 in: Lovel & Hudson (1985).
- Bengston, S.A. (1972). Athysanella varphatum falka (*Falco rusticolus*) Myvatnssveit 1960-1969. *Naturfrøeingning* **42**: 67-74.
- Bengston, S.A. (1975). Hunting methods and prey of an Icelandic population of Merlins (*Falco columbarius*). *Fauna och Flora* **70**: 8-12.
- Berenschein, R.J. (1977). Karyological differences between *Sagittarius* and *Cariacus* (Aves). *Experientia* **33**: 1021-1022.
- Berkenstein, H. (1975). *The Winter Food of the Helmeted Guinea-fowl* (Numida meleagris) and Swainson's *Frankolin* (Pternis swainsoni swainsoni) from Localities around Gwelo, Que Que and Simba, Rhodesia. Unpublished B.Sc. (Hons) thesis, University of Rhodesia, 36pp.
- Bennet, G.F., Gabaldón, A., & Ulloa, G. (1982). Avian Haemoproteidae. 17. The haemoproteids of the avian family Craciidae (Galliformes): the guans, curassows, and chachalacas. *Can. J. Zool.* **60**: 3105-3112.
- Bennett, P.M. (1990). Genetic problems in captive populations. Pp. 281-283 in Hill et al. (1990).
- Bennett, R.S., & Klaas, E.E. (1986). Bald Eagle pursues an injured Snow Goose in flight. *J. Raptor Res.* **20**: 75-76.
- Bensen, K.J. (1992). Dynamics of an American Swallow-tailed Kite communal roost at Corkscrew Swamp Sanctuary, Florida. *Florida Field Nat.* **20**(3): 65-71.
- Benshemesh, J. (1988). Report on a study of Malleefowl ecology. Report to Department of Conservation, Forests and Lands, Melbourne.
- Benshemesh, J. (1990). Management of Malleefowl - with regard to fire. Pp. 206-211 in: Noble, J.C., Joss, P.J., & Jones, G.K. eds. (1990). *The Malleefowl, a Conservation Perspective*. CSIRO, Melbourne, Australia.
- Benshemesh, J. (1992). *The Conservation Ecology of Malleefowl, with Particular Regard to Fire*. PhD thesis, Monash University, Clayton, Australia.
- Benson, C.W. (1951). A roosting site of the eastern Red-footed Falcon *Falco amurensis*. *Ibis* **93**: 467-468.
- Benson, C.W. (1960a). *The Birds of the Comoro Islands*. Results of the British Ornithologists' Union Centenary Expedition. 1958. *Ibis* **103B**.
- Benson, C.W. (1960b). Breeding seasons of some game and protected birds in Northern Rhodesia. *Black Lechwe* **2**: 149-158.
- Benson, C.W. (1961). Breeding season of some game birds. *Black Lechwe* **3**: 8-11.
- Benson, C.W. (1963). Breeding seasons of game birds in the Federations of Rhodesia and Nyasaland. *Puku* **1**: 51-69.
- Benson, C.W., & Benson, F.M. (1975). *The Birds of Malawi*. Monfort Press, Limbe, Malawi.
- Benson, C.W., & Irwin, M.P.S. (1966). The Common Quail *Coturnix coturnix* in the Ethiopian and Malagasy regions. *Arndolia (Rhodesia)* **2**: 1-14.
- Benson, C.W., & Penny, M.J. (1971). The land birds of Aldabra. *Phil. Trans. Roy. Soc., London* **B26**: 417-527.
- Benson, C.W., & Smithers, R.H.N. (1958). The Teita Falcon *Falco fasciatus* at the Victoria Falls. *Ostrich* **29**: 57-58.
- Benson, C.W., Colebrook-Robjent, J.F.R., & Williams, A. (1976). Contribution à l'ornithologie de Madagascar. *Oiseau et RFO* **46**: 103-134.
- Benson, P.C., Tarboton, W.R., Allan, D.G. & Dobbs, J.C. (1990). The breeding status of the Cape Vulture in the Transvaal, 1980-1985. *Ostrich* **61**: 134-142.
- Benson, S.V. (1970). *Birds of Lebanon and the Jordan Area*. ICBP, London & New York.
- Bent, A.C. (1932). *Life Histories of North American Gallinaceous Birds*. US National Museum Bulletin **162**. Washington.
- Bent, A.C. (1937). *Life Histories of North American Birds of Prey*. Order Falconiformes. Part I. US National Museum Bulletin **167**.
- Bente, P.J. (1981). *Nesting Behavior and Hunting Activities of the Gyrfalcon* (*Falco rusticolus*) in South Central Alaska. MSc thesis. University of Alaska, Fairbanks.
- van den Berg, A.B., & Bosman, C.A.W. (1986). Supplementary notes on some birds of Lore Lindu Reserve, central Sulawesi. *Forktail* **1**: 7-13.
- Berger, A.J. (1981). *Hawaiian Birdlife*. University Press of Hawaii, Honolulu.
- Berger, D.D., Hamerstrom, F., & Hamerstrom, F.N. (1963). The effect of raptors on Prairie Chickens on booming grounds. *J. Wildl. Manage.* **27**: 778-791.
- Bergerud, A.T. (1970a). Population dynamics of the Willow Ptarmigan *Lagopus lagopus alleni* L. in Newfoundland 1955-1965. *Oikos* **21**: 299-325.
- Bergerud, A.T. (1970b). Vulnerability of Willow Ptarmigan to hunting. *J. Wildl. Manage.* **34**: 282-285.
- Bergerud, A.T. (1985). The additive effect of hunting mortality on the natural mortality rates of grouse. Pp. 345-366 in: Beason, S.L., & Robertson, S.F. eds. (1985). *Game Harvest Management*. Caesar Kleberg Wildlife Research Institute, Kingsville, Texas.
- Bergerud, A.T. (1988a). Demography and behavior of insular Blue Grouse populations. Pp. 29-77 in: Bergerud & Gratson (1988b).
- Bergerud, A.T. (1988b). Mating systems in grouse. Pp. 439-472 in: Bergerud & Gratson (1988b).
- Bergerud, A.T. (1988c). Population ecology of North American grouse. Pp. 578-685 in: Bergerud & Gratson (1988b).
- Bergerud, A.T. (1988d). Increasing the numbers of grouse. Pp. 686-731 in: Bergerud & Gratson (1988b).
- Bergerud, A.T., & Butler, H.E. (1985). Aggressive and spacing behaviour of female Blue Grouse. *Auk* **102**: 313-322.
- Bergerud, A.T., & Gratson, M.W. (1988a). Survival and breeding strategies of grouse. Pp. 473-577 in: Bergerud & Gratson (1988b).
- Bergerud, A.T., & Gratson, M.W. eds. (1988b). *Adaptive Strategies and Population Ecology of Northern Grouse*. Wildlife Management Institute, University of Minnesota Press, Minneapolis.
- Bergerud, A.T., & Hemus, H.D. (1975). An experimental study of the behavior of Blue Grouse (*Dendragapus obscurus*). I. Differences between the founders from three populations. *Can. J. Zool.* **53**: 1222-1237.
- Bergerud, A.T., & Huxter, D.S. (1969). Breeding season habitat utilization and movement of Newfoundland Willow Ptarmigan. *J. Wildl. Manage.* **33**: 967-974.
- Bergerud, A.T., & Mercer, W.E. (1972). Spring food of Willow Ptarmigan *Lagopus lagopus alleni* in southeastern Newfoundland. *Oikos* **23**: 213-217.
- Bergerud, A.T., & Mossop, D.H. (1985). The pair bond in ptarmigan. *Can. J. Zool.* **62**: 2129-2141.
- Bergerud, A.T., Mossop, D.H., & Myrberget, S. (1985). A critique of the mechanics of annual changes in ptarmigan numbers. *Can. J. Zool.* **63**: 2240-2248.
- Bergerud, A.T., Peters, S.S., & McGrath, R. (1963). Determining sex and age of Willow Ptarmigan in Newfoundland. *J. Wildl. Manage.* **27**: 700-711.
- van den Bergh, W. (1975). Breeding the Congo Peacock at the Royal Society of Antwerp. Pp. 75-86 in: Martin, R.D. ed. (1975). *Breeding Endangered Species in Captivity*. Academic Press, London and New York.
- van den Bergh, W., Chardome, M., & Peel, E. (1963). Les parasites du Paon congolais, *Afropavo congensis* Chapin. I. *Haemaphysalis chapini*. 2. *Microfilaria chapini*. *Rev. Zool. Bot. Afr.* **67**: 74-80.
- Bergier, P. (1987). *Les Rapaces Diurnes du Maroc. Statut, Répartition et Ecologie*. Annales du C.E.E.P. (Centre d'Etudes sur les Ecosystèmes de Provence) 3. Aix-en-Provence, France.
- Bergier, P., & Cheylan, G. (1980). Statut, succès de reproduction et alimentation du Vautour percnoptère *Neophron percnopterus* en France Méditerranéenne. *Alauda* **48**: 75-97.
- Bergier, P., & de Naurais, R. (1985). Note sur la reproduction de l'Aigle de Bonelli *Hieraaetus fasciatus* en Afrique du Nord-Ouest. *Alauda* **53**(4): 257-262.
- Bergman, G. (1961). The food of birds of prey in Fennoscandia. *British Birds* **54**: 307-320.
- Bergman, S. (1963). Observations on the early life of *Tallegalla* and *Megapodius* in New Guinea. *Nova Guinea. Zool.* **17**: 347-357.
- Bergman, U. (1989). [How to identify the Spotted Eagle *Aquila clanga* Pallas and the Lesser Spotted Eagle *Aquila pomarina* C.L. Brehm]. *Puuti dabo*. Zinatne. Pp. 2: 113-122. In Latvian.
- Bergman, U. (1994). On the taxonomy of the Lesser Spotted Eagle *Aquila pomarina* and Greater Spotted Eagle *Aquila clanga*. In: Meyburg & Chancellor (1994b).
- Bergman, U., Petris, A., & Strazds, M. (1990). Lesser Spotted Eagle in Latvia - numbers, distribution and ecology. Pp. 35-38 in: Viksne, J., & Vilks, I. eds. (1990). *Baltic Birds 5. Ecology, Migration and Protection of Baltic Birds*. Proceedings of the Fifth Conference on the Study and Conservation of Migratory Birds on the Baltic Basin, Riga, October 5-10, 1987. Zinatne Publishers, Riga.
- Bergmann, H.H., Klaus, S., Müller, F., & Wiesner, J. (1975). Individualität und Artpezifität in den Gesangsstrophien einiger Populationen des Haselhuhns (*Bonasia bonasia* L., Tetraoninae, Phasianidae). *Behaviour* **55**: 94-114.
- Bergmann, H.H., Klaus, S., Müller, F., & Wiesner, J. (1982). *Das Haselhuhn*. Neue Brehm-Bücherei 77. A. Ziemsen Verlag, Wittenberg/Lutherstadt.
- Bergmann, H.H., Klaus, S., Wiesner, J., & Vitovic, O. (1991). Die "stumme Balz": Lautäußerungen männlicher Kaukasusirrhühner (*Tetrax mlokosiewiczii*) auf dem Balzplatz. *J. Orn.* **132**: 267-278.
- Berkelman, J. (1993). An autecological study of the Madagascar Buzzard *Buteo brachypterus*. Pp. 154 in: Wilson (1994a).
- Berkelman, J. (1994). The ecology of the Madagascar Buzzard *Buteo brachypterus*. In: Meyburg & Chancellor (1994a).
- Berliang, M., & Wood, P. (1992). Observations of the King Vulture *Sarcocorax papa* in the Calakm Biosphere Reserve, Campeche, Mexico. *Vulture News* **26**: 15-21.
- Bernal, L.G., Houston, D.C., & Cotton, P. (1994). The role of Greater Yellow-headed Vultures as scavengers in neotropical forests. *Ibis* **136**.
- Bernard, A. (1979). Régime alimentaire du Tétrax lyre en automne dans une zone de Mélières des Alpes françaises. *Bull. mens. ONC* **31**: 24-27.
- Bernard, A. (1981). Biologie du Tétrax lyre (*Tetrax tetrax* L.) dans les Alpes françaises: la sélection de l'habitat de reproduction par les poules. *Bull. mens. ONC* **Dec. **1981**: 87-184.**
- Bernard, A. (1982a). An analysis of Black Grouse nesting and brood habitats in the French Alps. Pp. 156-172 in: Lovel (1982).
- Bernard, A. (1982b). Note sur le régime alimentaire du Lagopède alpin dans les Alpes du Sud. *Bull. mens. ONC* **55**: 20-24.

- Bernard-Laurent, A. (1983). Comparaison des régimes alimentaires du Tétraz Lyre, *Lyrurus tetrix* (L.), et du Lagopède alpin, *Lagopus mutus* Montin, dans le val d'Aoste (Hautes-Alpes). *Rev. Ecol. (Terre Vie)* 37: 241-258.
- Bernard-Laurent, A. (1986). Régime alimentaire automnal de la Perdrix bartavelle (*Alectoris graeca saxatilis*) dans les Alpes-Maritimes. *Rev. Ecol. (Terre Vie)* 41: 39-57.
- Bernard-Laurent, A. (1987). Le régime alimentaire du lagopède alpin, *Lagopus mutus* (Montin, 1776): synthèse bibliographique. *Gibier Faune Sauvage* 4: 321-347.
- Bernard-Laurent, A. (1988). Les déplacements en automne et en hiver de perdrix rochers *Alectoris graeca saxatilis* x *Alectoris alta* dans les Alpes Méridionales et leurs déterminants. *Gibier Faune Sauvage* 5: 171-186.
- Bernard-Laurent, A. & Laurent, J.L. (1984). Méthode de recensement des Perdrix bartavelles (*Alectoris graeca saxatilis*) Bechstein (1805) au printemps: applications dans les Alpes-Maritimes. *Gibier Faune Sauvage* 4: 69-85.
- Bernard-Laurent, A., Léonard, P. & Reitz, F. (1992). Prélèvements de la Perdrix bartavelle (*Alectoris graeca saxatilis*) par la chasse: facteurs de variation et perspectives pour une gestion cynégétique des populations. *Gibier Faune Sauvage* 9: 1-25.
- Bernhoft, L.S. (1969). *Reproductive Ecology of Female Sharp-tailed Grouse and Food Habits of Broods in Southwestern North Dakota*. MSc thesis, University of North Dakota, Grand Forks.
- Bernis, F. (1966). El Buitre negro (*Aegypius monachus*) en Iberia. *Ardeola* 12: 45-99.
- Bernis, F. (1974a). Algunos datos de alimentación y depredación de Falconiformes y Strigiformes Ibéricos. *Ardeola* 19(2): 225-248.
- Bernis, F. (1974b). Más sobre fenología de reproducción y status de *Aquila chrysaetos* en Iberia. *Ardeola* 19(2): 447-454.
- Bernis, F. (1975). *Migración de Falconiformes y Ciconia spp. por Gibraltar*. *Ardeola* 21(Special Vol.).
- Bernis, F. (1980). *La Migración de las Aves en el Estrecho de Gibraltar (época post-nupcial)*. Cátedra de Zoología de Veterinarios, Universidad Complutense de Madrid.
- Bernstein, M.H. (1972). Development of thermoregulation in the Painted Quail *Excalfactoria chitensis*. *Comp. Biochem. Physiol. (Ser. A)* 44: 355-366.
- Berry, J.D. & Eng, R.L. (1985). Interseasonal movements and fidelity to seasonal use areas by female Sage Grouse. *J. Wildl. Manage.* 49: 237-240.
- Berry, M.P.S. (1972). Distribution of Crested Guinea-fowl. *Bull. Zambian Orn. Soc.* 4: 22.
- Berry, M.P.S. & Crowe, T.M. (1985). Effects of monthly and annual rainfall on game bird populations in the northern Cape Province, South Africa. *S. Afr. J. Wildl. Res.* 15(3): 69-76.
- Berry, R.J. (1981). Breeding the Nocturnal Curassow at the Houston Zoological Gardens. Pp. 267-272 in: Estudillo López (1981).
- Beshkarev, A.B. (1990). [Large-scale data on the size of Capercaillie *Tetrao urogallus* clutches]. *Ekologiya (Sverdlovsk)* 2: 79.
- Best, B.J. (1992). Ecuador and its Rufous-headed Chachalaca. *World Pheasant Assoc. News* 35: 27-30.
- Best, B.J. (1993). Rufous headed Chachalaca - Another one for the pot? *Craic News* 2(1): 11-12.
- Best, B.J. & Clarke, C.T. eds. (1991). *The Threatened Birds of the Socorro Region, Southwest Ecuador*. ICBP Study Report 44. Cambridge, England.
- Best, B.J., Clarke, C.T., Checker, M., Broom, A.L., Thewlis, R.M., Duckworth, W. & McNab, A. (1993). Distributional records, natural history notes, and conservation of some poorly known birds from southwestern Ecuador and northwestern Peru. *Bull. Brit. Orn. Club* 113(2): 108-119.
- Betts, F.N. (1947). Bird life in an Assam jungle. *J. Bombay Nat. Hist. Soc.* 46: 667-684.
- Betts, F.N. (1953). The birds of Coorg. *J. Bombay Nat. Hist. Soc.* 50: 248-251.
- Betts, F.N. (1966). Notes on some resident breeding birds of south-west Kenya. *Ibis* 108: 513-530.
- Beukemoet, L., Dijkstra, C., Daan, S. & Meijer, T. (1988). Seasonality of clutch size determination in the kestrel *Falco tinnunculus*: an experimental approach. *Ornis Scand.* 19: 41-48.
- van Beusekom, C.F. (1972). Ecological isolation with respect to food between Sparrowhawk and Goshawk. *Ardea* 60: 72-96.
- Beville, W.V. (1973). Some factors influencing gobbling activity among Wild Turkeys. *Proc. Ann. Conf. Southeast. Assoc. Game & Fish Comm.* 27: 62-73.
- Bezdek, H. (1944). Sex ratios and colour phases in two races of Rufous Grouse. *J. Wildl. Manage.* 8: 85-88.
- Biaggi, V. (1983). *Las Aves de Puerto Rico*. Editorial de la Universidad de Puerto Rico, Rio Piedras, Puerto Rico.
- Blanski, V.L. (1989). *Obzor vidov roda Tetraogallus Gray* [Review of the genus *Tetraogallus* Gray]. *Echeverdi, Zool. Muzeja Akad. Nauk (Proceedings of Zool. Museum Empire's Academy of Sciences, St. Petersburg)* 3: 113-123.
- Bilber, J.P. (1990). *Action Plan for the Conservation of Western Lesser Kestrel Falco naumanni populations*. ICBP study report 40. Cambridge, England.
- Biddulph, C.H. (1937). Numbers of eggs laid by the Indian Shikra (*Accipiter badius dussumieri* (Temm. & Lang.). *J. Bombay Nat. Hist. Soc.* 37: 406.
- Biedulph, J. (1881). The birds of Gilgit. *Stray Feathers* 9: 301-66.
- Bielefeldt, J. & Cary, J. (1991). Copulatory and other pre-incubation behaviors of Cooper's Hawks. *Wilson Bull.* 103: 656-660.
- Bielefeldt, J., Rosenfield, R.N. & Papp, J.M. (1992). Unfounded assumptions about diet of Cooper's Hawk. *Condor* 94: 427-436.
- Bierregaard, R.O. (1985). Observations of the nesting biology of the Guiana Crested Eagle (*Morphnus guianensis*). *Wilson Bull.* 96(1): 1-5.
- Bierregaard, R.O. (1988). Morphological data from understory birds in terra firme forest in the central Amazonian basin. *Rev. Brasil. Zool.* 48(2): 169-178.
- Biggs, H.C., Biggs, R. & Freyer, E. (1984). Observations on the Chanting Goshawk *Melierus caninus* during a period of poor rainfall. Pp. 61-70 in: *Proc. 2nd Symp. Afr. Pred. Birds*. Natal Bird Club, Durban.
- Biggs, R. & Biggs, H. (1978). Comparative portraits of Steppe and Tawny Eagles. *Bokmakere* 30: 77.
- Billeveid, M. (1974). *Birds of Prey in Europe*. Macmillan Press, London.
- Bijlma, B.G. (1980). *De Boornvuk*. Kosmos, Vogelmonografieën, Amsterdam.
- Bijlsma, R.G. (1991). Trends in European Goshawks (*Accipiter gentilis*): an overview. *Bird Census News* 4: 3-47.
- Bijlsma, R., Hagemeijer, E.J.M., Verkleij, G.J.M. & Zollinger, R. (1988). *Ecological aspects of the Lesser Kestrel Falco naumanni in Extremadura (Spain)*. Rapport 285. Katholieke Universiteit Nijmegen, Nijmegen.
- Bjeldstén, K.L. (1978). *Behavioral Ecology of Red-tailed Hawks (Buteo jamaicensis), Rough-legged Hawks (Buteo lagopus), Northern Harriers (Circus cyaneus), and American Kestrels (Falco sparverius) in South Central Ohio*. Ohio Biol. Surv. Biol. Notes 18.
- Bille, R.P. (1969). Sur le comportement hivernal et les gîtes de Tétraz lyre dans les Alpes. *Nov. Oiseaux* 30: 80-86.
- Binney, R.J. & Emison, W.B. (1983). Breeding of the White-bellied Sea-Eagle in the Gippsland Lakes region of Victoria. *Austral. Austr. Bird Watcher* 10: 61-68.
- Bonfield, L.C. (1989). *A Descriptive Survey of the Birds of the Mexican State of Oaxaca*. Ornithological Monographs 43. American Ornithologists' Union.
- Binn, G., Hammond, K. & Harrap, F. (1991). An association of five Square-tailed Kites in spring in Victoria. *Austr. Bird Watcher* 14: 106-107.
- Bird, D.M. (1985). *Biology and Management of Bald Eagles and Ospreys*. Harper & Row, New York.
- Bird, D.M. & Bowman, R. eds. (1987). *The Ancestral Kestrel Raptor Research Report 6*. Raptor Research Foundation & Macdonald Raptor Research Center of McGill University, Quebec.
- Birkman, M. (1972). Réussite des lâchers de Perdrix perdus et de Perdrix rouges *Alectoris alta* d'élevage. *Bulletin Spécial du Conseil Supérieur de la Chasse, Gallinates gibier* 15: 44-58.
- Birkman, M. & Jacob, M. (1988). *La Perdrix Gine*. Hater, Paris.
- Birkman, M. & Serre, D. (1988). Disparition, domaine vital et utilisation du milieu de janvier à mai chez la Perdrix perdus. *Bulletin Spécial du Conseil Supérieur de la Chasse, Gallinates gibier* 15: 989-1000.
- Birkman, M., Potts, G.R., Aebischer, N. & Dowell, S.D. eds. (1992). *First International Symposium on Partridges, Quails and Francolins*. Fordingbridge, UK, September 7-14 1991. *Gibier Faune Sauvage* 9(Special Vol.).
- Birkman, M., Serre, D., Skibiński, S. & Pelard, E. (1992). Spring summer home range, habitat use and survival of Grey Partridge *Perdix perdix* in a semi-open habitat. Pp. 431-442 in Birkman, Potts et al. (1992).
- Birkhead, T.R. & Fletcher, F. (1994). Sperm storage and the release of sperm from the sperm storage tubules in Japanese Quail *Coturnix japonica*. *Ibis* 136(1): 101-105.
- Blackburn, T.R. & Lessells, C.M. (1988). Correlation between the Ostrine. *Anim. Behav.* 36: 1672-1682.
- Birks, S.M. (1981). *Summary of the Australian Brush-turkey all that work and no work*. Pp. 369 in: *10th XX Int. Orn. Congr. Christchurch, 1990 (Suppl.)*.
- Birks, S.M. (1991). Female mate choice in Australian Brush-turkeys. *J. World Pheasant Assoc.* 33: 21-26.
- Birks, S.M. (1992). Mate choice in Australian Brush-turkeys *Alectura lathamii*: a preliminary report. Pp. 43-52 in: *Decker & Jones* (1992).
- Bishop, D. & Stronach, L. (1979). The Scrubfowl *Megeopodius trossus* in West New Britain. *World Pheasant Assoc.* 31: 80-82.
- Bishop, K.D. (1980). A revision of the information claim to the occurrence of *Megeopodius trossus* in the status of Papua New Guinea. *J. World Pheasant Assoc.* 32: 23-30.
- Bishop, K.D. (1983). Birds of the volcanoes - the scrubfowl of West New Britain. *World Pheasant Assoc.* 35: 235-241.
- Bishop, K.D. (1986). Dora's Hawk *Megatriorchus doriae* on Batanta Island, Irian Jaya. *Kukula* 2: 85.
- Bishop, K.D. (1992). New and interesting records of birds in Wallacea. *Kukula* 6(1): 8-34.
- Bishop, K.D., Bishop, D. & Coates, B.J. (1994). *A Guide to the Birds of Wallacea*. Dove Publishers, Brisbane [1995].
- Bishop, K.D. (1994). *The Mearns Quail (Cyrtonyx montezumensis) in Southern Arizona*. MSc thesis, University of Arizona, Tucson.
- Bishop, R.A. & Hungerford, C.R. (1965). Seasonal food selection of Arizona Mearns Quail. *J. Wildl. Manage.* 29: 813-819.
- Bishti, M., Lakhera, P. & Saklani, A.C. (1990). Himalayan Monal Pheasant: current status and habitat utilization in Kedarnath Sanctuary, Garhwal Himalaya, India. Pp. 205-208 in Hill et al. (1990).
- Bliswas, B. (1968). The female of Molesworth's Tragopan *Tragopan blythi molesworthi* Baker. *J. Bombay Nat. Hist. Soc.* 65: 782-784.
- Bjogstad, A.J. ed. (1988). *Prairie Chickens on the Shenandoah National Grasslands*. US Department of Agriculture Forest Service, General Technical Report RM-159.
- Blaber, S.J.M. (1990). Checklist and notes on the current status of the birds of New Georgia, Western Province, Solomon Islands. *Emu* 90: 205-214.
- Black, H.L., Howard, G. & Stjernstedt, R. (1979). Observations on the feeding behaviour of the Bat Hawk *Macheiramphus alcinus*. *Biometica* 11: 18-21.
- Black, R.A.R. & Ross, G.J.B. (1970). Aspects of adaptive radiation in southern African accipiters. *Ann. Cape Prov. Mus. (Nat. Hist.)* 8: 57-65.
- Blackburn, A. (1971). Some notes on Fijian birds. *Natorus* 18: 147-174.
- Blackburn, J.L. (1963). Further observations on the breeding behavior of a Blue Grouse population in Montana. *Condor* 65: 485-513.
- Blair, C.L. & Schlotter, F. (1982). Breeding biology and diet of the Ferruginous Hawk in South Dakota. *Wilson Bull.* 94: 46-54.
- Blake, C.S. (1970). The response of Sage Grouse populations to precipitation trends and habitat quality in south central Idaho. *Proc. West. Assoc. State Game and Fish Comm.* 50: 452-462.
- Blake, E.R. (1953). *Birds of Mexico*. University of Chicago Press, Chicago.
- Blake, E.R. (1955). A collection of Colombian game birds. *Fieldiana Zool.* 37: 9-23.
- Blake, E.R. (1958). Birds of Volcán de Chiriquí, Panama. *Fieldiana Zool.* 36: 498-577.
- Blake, E.R. (1962). A new race of *Penelope montagnii* from southeastern Peru. *Fieldiana Zool.* 44(14): 121-122.
- Blake, E.R. (1977). *Manual of Neotropical Birds*. Vol. 1. Sphenisciformes (Penguins) to Laridae (Gulls and Albes). The University of Chicago Press, Chicago & London.
- Blake, E.R. & Hanson, H.C. (1942). Notes on a collection of birds from Michoacán, Mexico. *Field Mus. Nat. Hist. (Zool. Ser.)* 22: 513-551.
- Blakely, K.L., Crawford, J.A., Lutz, R.S. & Kilbridge, K.M. (1990). Response of key foods of California Quail to habitat manipulation. *Wildl. Soc. Bull.* 18: 240-245.
- Blakers, M., Davies, S.J.J.F. & Reilly, P.N. (1984). *The Atlas of Australian Birds*. Melbourne University Press, Carlton, Victoria.
- Blanco, G., Herrera, M.A., Fargallo, J.A. & Cuevas, J.A. (1993). Female participation in courtship displays of Western Marsh Harriers (*Circus aeruginosus*) in central Spain. *J. Raptor Res.* 27(3): 165-166.
- Blanco, J.C., González, J.L. & Hiraldo, F. (1990). Trophic and spatial relationships between wintering Red Kites (*Milvus milvus*) and Marsh Harriers (*Circus aeruginosus*) in the Guadalquivir marshes. *Mis. Zool.* 14: 161-166.
- Blanco, J.C., Hiraldo, F. & Hiraldo, B. (1990). Variations in the diet and foraging behaviour of a wintering Red Kite (*Milvus milvus*) population in response to changes in food availability. *Audubon* 37(2): 267-278.
- Blanco, J.C., Hiraldo, F. & García, L. (1987). Alimentación invernal del Milano Real *Milvus milvus* (L., 1758) en el Parque Nacional de Doñana. *Bolet. Estac. Cient. Ecol.* 16(31): 93-97.
- Bland, J.D. (1987). Patterns of summer habitat use by Himalayan Snowcock *Tetraogallus himalayensis* in Nevada, USA. Pp. 119-124 in: *Savage & Rieley* (1987).
- Bland, J.D. & Han Lian-xian (1993). Unintentional maintenance of Lady Amherst Pheasant habitats in rural Yunnan. Pp. 134-136 in: *Jenkins* (1993).
- Bland, J.D. & Temple, S.A. (1990). Effect of predation risk on habitat use by Himalayan Snowcocks. *Oecologia* 82: 187-191.
- Bland, T.H. & Ash, J.S. (1956). The concept of the territory in the Partridge *Perdix p. perdix*. *Proc.* 98: 379-389.
- Blank, T.H. & Ash, J.S. (1960). Some aspects of clutch size in the Partridge (*Perdix p. perdix*). *Proc.* 118: 126 in: *Proc. XII Int. Orn. Congr. Helsinki 1958*.
- Blank, T.H., Southwood, T.R.E. & Cross, T.J. (1967). The ecology of the Partridge 1. Outline of population processes with particular reference to chick mortality and nest density. *J. Appl. Ecol.* 36: 549-556.
- Blankenship, L., Field, C.R. & Parker, I.C.S. (1971). Swallow-tailed Kites *Elaenia vociferans* in the Kedong Valley. *East Afr. Nat. Hist. Soc. Bull.* 11: 187.
- Blaser, H. (1965). A propos de la parade du Tétraz lyre *Lyrurus tetrix* (L.). *Nov. Oiseaux* 28: 73-87.
- Bloch, H., Poulsen, M.K., Rahbek, C. & Rasmussen, J.F. (1991). *A Survey of the Montane Forest Avifauna of the Loja Province, Southern Ecuador*. ICBP Study Report 49. Cambridge, England.
- Block, W.M., Brennan, L.A. & Gutiérrez, R.J. (1984). Mountain Quail habitat ecology study: progress to date. *Covey Rise* 3: 3.
- Block, W.M., Brennan, L.A. & Gutiérrez, R.J. (1991). Ecomorphological relationships of a guild of ground-foraging birds in northern California, USA. *Oecologia* 87: 449-458.
- Blockstein, D.E. (1988). Two endangered birds of Grenada, West Indies: Grenada Dove and Grenada Hawk-billed Kite. *Caribb. J. Sci.* 24(3-4): 127-136.
- Blom, R. (1980). *Spring Feeds of the Willow Grouse Lagopus lagopus on Innis, Northern Norway*. Cand. Real. thesis, University of Bergen, Norway.
- Blondel, J. (1964). Notes sur la biologie et le régime alimentaire du Faucon Crécerellette, *Falco naumanni*. *Nos Oiseaux* 28: 295-298.
- Blondel, J., Coulon, L., Girard, B. & Hortigue, M. (1969). Deux cents heures d'observation auprès de l'Aigle de Bonelli *Hierosylus fasciatus*. *Nos Oiseaux* 32: 323-374.
- Bloom, P.H. (1989). *Red-shouldered Hawk (Buteo lineatus) and Harris' Hawk (Buteo swainsoni)*. MSc thesis, California State University, Long Beach, California.
- Bloom, P.H. & Hawks, S.J. (1983). Nest box use and reproductive biology of the American Kestrel in Lassen County, California. *J. Raptor Res.* 17: 9-14.
- Bloom, P.H., McCarty, D. & Gibson, M.J. (1993). Red-shouldered Hawk home-range use in southern California. *J. Wildl. Manage.* 57: 58-265.
- Blot, J. (1983). Contribution à la connaissance de la biologie et de l'écologie de *Lanius excubitorides* Dorsé et Jouanin. *Alauda* 33: 244-256.
- Blumstein, D.T. (1990). An observation of social play in Bearded Vultures. *Condor* 92(3): 779-781.
- Blumstein, D.T. & López, J. (1993). Habitat use by Himalayan Snowcocks. Pp. 142-143 in: *Jenkins* (1993).
- Blus, L.J., Henny, C.J. & Grove, R.A. (1985). Effects of pelletized anticoagulant rodenticides on California Quail. *J. Wildl. Dis.* 21: 391-395.
- Blus, L.J., Staley, C.S., Henny, C.J., Pendleton, G.W., Craig, T.H., Craig, E.H. & Halford, D.K. (1989). Effects of organophosphorus insecticides on Sage Grouse in southwestern Idaho. *J. Wildl. Manage.* 53: 143-154.
- Boag, D.A. (1964). *A Population Study of the Blue Grouse in Southwest Alberta*. PhD thesis, Washington State University, Pullman.
- Boag, D.A. (1965). Indicators of sex, age, and breeding phenology in Blue Grouse. *J. Wildl. Manage.* 29: 103-108.
- Boag, D.A. (1983). Population attributes of Blue Grouse in southwestern Alberta. *Can. J. Zool.* 61: 2074-2079.
- Boag, D.A. (1976). The effect of shrub removal on occupancy of Rufous Grouse drumming sites. *J. Wildl. Manage.* 40: 105-110.
- Boag, D.A. (1991). Spring population density of Spruce Grouse and pine forest maturation. *Ornis Scand.* 22: 181-185.
- Boag, D.A. & Schmeder, M.A. (1987). Population fluctuations in Spruce Grouse: what determines their numbers in spring? *Can. J. Zool.* 65: 2430-2435.
- Boag, D.A. & Schmeder, M.A. (1992). *Spring phenology*. No. 5 in: *Boag et al.* (1992).
- Boag, D.A. & Stomach, K.M. (1990). Characteristics of drumming sites selected by Rufous Grouse in Alberta. *J. Wildl. Manage.* 54: 621-628.
- Boag, D.A., Metcalf, C. & H. Henny, C.W. & Alway, J.H. (1990). Population regulation in the Spruce Grouse: a working hypothesis. *Can. J. Zool.* 67: 2275-2284.
- Boag, D.A., Krebs, A.C. & Schmeder, M.A. (1992). *Population dynamics of Spruce Grouse in British Columbia*. MSc thesis, University of British Columbia, Vancouver.
- Board, R.G., Perrotti, H.R., Love, G. & Seymour, R.S. (1982). A novel pore system in the eggshells of Mallardfowl. *Leipna ocellata*. *J. Exper. Zool.* 220: 131-134.

- Boback, A.W. & Müller-Schwarze, D. (1968). *Das Burkhuhn*. Neue Brehm-Bücherei 397. A. Ziemsen Verlag, Wittenberg Lutherstadt.
- Bocca, M. (1987). *Studio sulle Popolazioni Valdostane del Fagiano di Monte Tetraro*. Aosta, Italy.
- Buck, C.E. & Lephinen, L.W. (1977). Geographic ecology of the common species of *Buteo* and *Parabuteo* wintering in North America. *Condor* 78: 554-557.
- Buck, W.F. (1976). *Beiträge zur Biologie der Rohwehe (Circus aeruginosus aeruginosus) in Schleswig-Holstein*. T. 1. Bielefeld.
- Buck, W.F. (1978). Jagdgebiet und Ernährung der Rohwehe (*Circus aeruginosus*) in Schleswig-Holstein. *J. Orn.* 119: 298-307.
- van Bockstaele, R. (1988). *Studbook of the Congo Peacock Afropavo congensis*. Royal Zoological Society of Antwerp, Belgium.
- van Bockstaele, R. (1993a). Genetic, demographic, nutritional and ethological analyses as tools for management. Pp. 106-107 in Jenkins (1993).
- van Bockstaele, R. (1993b). Studbooks and breeding registers for pheasants. Pp. 108-109 in Jenkins (1993).
- Boeker, E.J. & Ray, T.D. (1971). Golden Eagle population studies in the South-West. *Condor* 73: 463-467.
- de Boer, L.E.M. & Belterman, R.H.R. (1981). Chromosome banding studies of the Razor-billed Curassow, *Crax mitu* (Aves: Galliformes, Cracidae). *Genetica, Dordrecht* 54: 225-232.
- de Boer, L.E.M. & van Bockstaele, R. (1981). Somatic chromosomes of the Congo Peafowl (*Afrapavo congensis*) and their bearing on the species' affinities. *Condor* 83: 204-208.
- Bogorodskii, Yu.A. (1988). [Pernis ptilorhynchus in south Baikal]. Pp. 34-35 in: Shvetsov, Yu.G. ed. (1988). *Redkie i ozonovye pozvonochnye Sibiri [Rare Terrestrial Vertebrates of Siberia]*. Nauka, Novosibirsk. In Russian.
- Bohl, W.H. (1964). A Study and Review of the Japanese Green and the Korean Ring-necked Pheasant. US Fish and Wildlife Service, Special Scientific Report, Wildlife 83.
- Bohl, W.H. & Gordon, S.P. (1958). A range extension of *Meleagris gallopavo mexicana* in southwestern New Mexico. *Condor* 60: 338-339.
- Bohm, R.F. (1978). A study of nesting Red-tailed Hawks in Minnesota. *Loon* 50: 129-137.
- Bohm, R.T. (1977). Artificial nest platforms for raptors. *J. Raptor Res.* 11: 97-99.
- Bohm, R.T. (1988). Three Bald Eagle nests on a Minnesota transmission line. *J. Raptor Res.* 22: 34.
- Böhmer, J. & Immelmann, K. (1987). Aufbau, Variabilität und mögliche Funktionen des Rudelfußes beim Thermometerhuhn *Lepus ocellata*. *J. Orn.* 128: 91-100.
- Boinski, S. & Scott, P.L. (1988). Association of birds with monkeys in Costa Rica. *Biologica* 20(2): 136-143.
- Boinski, S. & Timm, R.M. (1985). Predation by squirrel monkeys and Double-toothed Kites on tent-making bats. *Amer. J. Primatol.* 9(2): 121-127.
- Bokermann, W.C.A. (1978). Observações sobre hábitos alimentares do gavião *Geranospiza caerulescens* (Vieillot, 1817) (Aves, Accipitridae). *Rev. Brasil. Biol.* 38(3): 715-720.
- Bokotev, A.A. (1994). Greater Spotted Eagle *Aquila clanga* breeding in Western Ukraine. In: Meyburg & Chancellor (1994b).
- Bolander, G.L. & Arnold, J.R. (1965). An abundance of White-tailed Kites in Sonoma County, California. *Condor* 67(3): 446.
- Bolau, H. (1894). Der Riesen-Seeadler und der Korea-Seeadler im Zoologischen Garten in Hamburg. *Zool. Garten* 35: 193-194.
- Bolen, E.G. & Flores, D. (1993). *The Mississippi Kite*. University of Texas Press, Austin, Texas.
- Bollen, C. (1989). Notes on Little Eagles breeding on the Southern Tablelands of New South Wales. *Austr. Bird Watcher* 13: 65-66.
- Bollen, C. (1991a). Further notes on the Little Eagle on the Southern Tablelands of New South Wales. *Austr. Bird Watcher* 14: 110-111.
- Bollen, C. (1991b). Breeding behaviour and diet of the Australian Kestrel *Falco cenchroides* on the Southern Tablelands of New South Wales. *Austr. Bird Watcher* 14: 44-50.
- Bollen, C. (1993). Breeding behaviour and diet of the Brown Falcon *Falco berigora* on the Southern Tablelands of New South Wales. *Austr. Bird Watcher* 15: 19-23.
- Bologna, G. (1977). On the situation of the Egyptian Vulture in Italy. In: Chancellor (1977).
- Bombardieri, M. (1992). *Predatory Behaviour of American Kestrels and Effects of Trichinella pseudospiralis infection*. MSc thesis, McGill University, Canada.
- Bonczar, Z. & Swenson, J.E. (1992). Geographical variation in spotting patterns on Hazel Grouse *Bonasa bonasia* primary leathers: consequences for age determination. *Ornis Fenn.* 69: 193-197.
- Bonczar, Z. & Vrobel, R. (1991). [Diet composition and feeding activity of Hazel Grouse (*Tetrastes bonasia* L.)]. *Acta Agraria et Silviculturae Series Zootecnica* 29: 3-12. In Polish with English summary.
- Bond, F.M. (1972). The Peregrine, Prairie, and Aplomado Falcons in the southwest. Pp. 51-55 in: *Symposium on Rare and Endangered Wildlife of the Southwestern United States*. Department of Game and Fish, Santa Fe, New Mexico.
- Bond, J. (1927). Nesting of the Harpy Eagle. *Auk* 44: 562-563.
- Bond, J. (1936). Resident birds of the Bay Islands of Spanish Honduras. *Proc. Acad. Nat. Sci. Philadelphia* 88: 353-364.
- Bond, J. (1956). *Check-list of Birds of the West Indies*. Academy of Natural Sciences of Philadelphia.
- Bond, J. (1964). White-tailed Kite in Nicaragua. *Auk* 81: 230.
- Bond, J. (1979). *Birds of the West Indies*. 4th edition. Collins, London.
- Bond, J. & Meyer de Schauensee, R. (1942/43). The birds of Bolivia. Part 1. *Proc. Acad. Nat. Sci. Philadelphia* 94: 307-391, 95: 167-221.
- Bond, R.M. (1940). Food habits of the White-tailed Kite. *Condor* 42(3): 168.
- Bonin, B. & Strenna, L. (1986). Sur la biologie du Faucon Crécerelle *Falco tinnunculus* en Auxois. *Alauda* 54: 241-262.
- Bonnet, J., Terrasse, M., Bagnolini, C. & Pinna, J.L. (1990). Installation et extension d'une colonie de Vautours fauves *Gyps fulvus fulvus* réintroduite dans les Grands Causses du Massif Central. *Oiseau et RFO* 60: 181-206.
- Bonora, M. & Chiavetta, M. (1975). Contribuzione à l'étude du Faucon lanier *Falco biarmicus feldeggii* en Italie. *Nos Oiseaux* 33: 153-168.
- Booth, B.D. (1961). Breeding of the Sooty Falcon in the Libyan desert. *Ibis* 103A: 129-130.
- Booth, D.T. (1984). Thermoregulation in neonate Malleefowl *Leipoa ocellata*. *Physiol. Zool.* 57: 251-260.
- Booth, D.T. (1985a). *Ecological Physiology of Malleefowl (Leipoa ocellata)*. PhD thesis, University of Adelaide.
- Booth, D.T. (1985b). Thermoregulation in neonate Brush-turkeys (*Alectura luhmanni*). *Physiol. Zool.* 58: 374-379.
- Booth, D.T. (1986). Crop and gizzard contents of two Malleefowl. *Emu* 86: 51-53.
- Booth, D.T. (1987a). Home range and hatching success of Malleefowl, *Leipoa ocellata* Gould (Megapodiidae), in Murray Mallee near Renmark, S.A. *Aust. Wildl. Res.* 14: 95-104.
- Booth, D.T. (1987b). Effect of temperature on development of Malleefowl *Leipoa ocellata* eggs. *Physiol. Zool.* 60: 437-445.
- Booth, D.T. (1987c). Metabolic response of Malleefowl *Leipoa ocellata* embryos to cooling and heating. *Physiol. Zool.* 60: 446-453.
- Booth, D.T. (1987d). Water flux in Malleefowl *Leipoa ocellata* Gould (Megapodiidae). *Aust. J. Zool.* 35: 147-159.
- Booth, D.T. (1988a). Respiratory quotient of Malleefowl (*Leipoa ocellata*) eggs late in incubation. *Comp. Biochem. Physiol.* 90A: 445-447.
- Booth, D.T. (1988b). Shell thickness in megapode eggs. *Megapode Newsl.* 2: 13.
- Booth, D.T. (1988a). Metabolism in Malleefowl *Leipoa ocellata*. *Comp. Biochem. Physiol.* 92A: 207-209.
- Booth, D.T. (1989b). Growth rates of Malleefowl and an Australian Brush-turkey in captivity. *Megapode Newsl.* 3: 9-10.
- Booth, D.T. & Seymour, R.S. (1984). Effect of girdling water to Malleefowl embryos during a drought. *Emu* 84: 116-118.
- Booth, D.T. & Seymour, R.S. (1987). Effect of eggshell thinning on water vapor conductance of Malleefowl eggs. *Condor* 89: 454-459.
- Booth, D.T. & Thompson, M.B. (1991). A comparison of reptilian eggs with those of megapode birds. Pp. 325-344 in: Ferguson, M.W.J. & Deeming, D.C. eds. (1991). *Egg Incubation: its Effects on Embryonic Development in Birds and Reptiles*. Cambridge University Press, Cambridge, England.
- Borell, W.D. (1985). The distribution and status of Cape Vulture colonies in Botswana in 1984. *Vulture News* 14: 19-22.
- Borell, W.D. (1986). First protected Cape Vulture breeding site in Botswana. *Vulture News* 15: 19-20.
- Borell, W.D. & Borell, R.M. (1988). Possible extension of (known) range of the Dickinson's Kestrel *Falco Dickinsoni* in Botswana. *Bonaparte* 18: 183-184.
- Borell, W.D. & Borell, R.M. (1993). Demographic trends in Cape Goshawk *Circus capensis* colonies in Botswana. 1963-1992. Pp. 123-131 in: Wilson (1993).
- Borodin, A.M. ed. (1984). *Red Data Book of the USSR: Rare and Endangered Species of Animals and Plants*. Vol. 1. Animals. 2nd edition. Leningrad promyshlennost, Moscow. In Russian.
- Borodin, A.M., Bannikov, A.G. & Sokolov, V.E. (1984). *Tetrao gallus altaicus* Gebler, 1936. In: Borodin (1984). In Russian.
- Borrero, H.J.I. (1972). *Aves de Caza Colombiana*. Departamento de Biología, Universidad del Valle, Colombia.
- Boerset, E. & Krafft, A. (1973). Black Grouse *Lyrurus tetrix* and Capercaillie *Tetrao urogallus* brood habitats in a Norwegian spruce forest. *Oikos* 24: 1-7.
- Borshchinskii, V.G. (1988). [Possible reasons for variations in the size of the clutch of the Capercaillie *Tetrao urogallus* L.]. *Biologicheskii Nauch* 10: 44-50. In Russian with English summary.
- Borshchinskii, V.G. (1990). [Age composition of the territorial grouping of Capercaillie (*Tetrao urogallus*) in the west of the Arkhangelsk district (Russian SFSR, USSR)]. *Zoologicheskii Zhurnal* 69: 94-104.
- Bortolotti, G.R. (1984). Criteria for determining age and sex of nestling Bald Eagles. *J. Field Orn.* 55: 467-481.
- Boshoff, A.F. (1993). Density, breeding performance and stability of Martial Eagles *Polemaetus bellicosus* breeding on electricity pylons in the Nama-Karoo, South Africa. Pp. 95-104 in: Wilson (1993).
- Boshoff, A.F. & Currie, M.H. (1981). Notes on the Cape Vulture *Gyps coprotheres* colony at Potberg, Bredasdorp, South Africa. *Ostrich* 52: 1-8.
- Boshoff, A.F. & Palmer, N.G. (1980). Macro-analysis of prey remains from Martial Eagle *Polemaetus bellicosus* nests in the Cape Province. *Ostrich* 51: 7-13.
- Boshoff, A.F. & Palmer, N.G. (1983). Aspects of the biology and ecology of the Osprey in the Cape Province, South Africa. *Ostrich* 54: 189-204.
- Boshoff, A.F. & Palmer, N.G. (1988). Black Eagle nest spacing and estimated territory size in a karoo habitat. *S. Afr. J. Wildl. Res.* 18: 67-68.
- Boshoff, A.F. & Robertson, A.S. (1985). A conservation plan for the Cape Vulture colony at Potberg, de Hoop Nature Reserve, Southwestern Cape Province. *Bioteknik* 4: 25-31.
- Boshoff, A.F. & Vernon, C.J. (1980a). Past and present distribution and status of the Cape Vulture *Gyps coprotheres* in the Cape Province, South Africa. *Ostrich* 51: 230-250.
- Boshoff, A.F. & Vernon, C.J. (1980b). The distribution and status of some eagles in the Cape Province. *Ann. Cape Prov. Mus. (Nat. Hist.)* 13: 107-132.
- Boshoff, A.F., Palmer, N.G. & Avery, G. (1990). Regional variation in the diet of Martial Eagles in the Cape Province. *S. Afr. J. Wildl. Res.* 20: 57-68.
- Boshoff, A.F., Palmer, N.G., Avery, G., Davies, R.A.G. & Jarvis, M.J.F. (1991). Biogeographical and topographical variation in the diet of the Black Eagle in the Cape Province, South Africa. *Ostrich* 62: 59-72.
- Boshoff, A.F., Rous, R.C. & Vernon C.J. (1981). Prey of the Tawny Eagle *Aquila rapax* in the Colesberg district Cape Province. *Ostrich* 52: 187-188.
- Bossert, A. (1976). Nahrungsökologie Untersuchungen am Alpenschneehuhn (*Lagopus mutus* Montin) im Aletschgebiet. *Rev. Suisse Zool.* 23: 880-883.
- Bossert, A. (1977). Bestandesaufnahmen am Alpenschneehuhn *Lagopus mutus* im Aletschgebiet. *Orn. Berh.* 74: 95-98.
- Bossert, A. (1980). Winterökologie des Alpenschneehuhns (*Lagopus mutus* Montin) im Aletschgebiet, Schweizer Alpen. *Orn. Berh.* 77: 121-166.
- Bossert, A., Marti, C. & Niederhauser, F. (1983). Zur Bestandsentwicklung des Alpenschneehuhns (*Lagopus mutus*, Montin) im Aletschgebiet (Zentralalpen) von 1973-1983. *Bull. de la Murithienne* 100: 39-49.
- Boswall, J. (1970). Age of acquiring adult plumage in *Gypaetus barbatus*. *Bull. Brit. Orn. Club* 90: 120.
- Boswall, J. (1977). Notes on tool-using by Egyptian Vultures *Neophron percipio*. *Bull. Brit. Orn. Club* 97: 77-78.
- Botelho, E.S., Gennaro, A.L. & Arrowood, P.C. (1993). Parental care, nesting behaviors and nesting interactions in a Mississippi Kite (*Ictinia mississippiensis*) nest. *J. Raptor Res.* 27: 16-20.
- Boudarel, P. (1985). *Recherches Préliminaires sur le Lagopède Alpin (Lagopus mutus) dans les Pyrénées Occidentales*. Acta Biologica Montana, série doc. travail. 1. 146 pp.
- Boudarel, P. (1987). Données sur l'écologie du lagopède *Lagopus mutus* dans le massif d'Ossau (Pyrénées Atlantiques). *Acta Biologica Montana* 7: 11-34.
- Boudarel, P. (1988). Recherches sur l'habitat et le comportement spatial du Lagopède alpin (*Lagopus mutus*) dans les Pyrénées-Occidentales françaises. *Gibier Faune Sauvage* 5: 227-254.
- Boudarel, P. (1989). *Essai sur l'insertion du Lagopède Alpin (Lagopus mutus pyrenaicus) dans les écosystèmes d'altitude Pyrénéennes*. Thèse de doctorat, University of Pau, France.
- Boudarel, P. & Garcia, R. (1991). Approche du régime alimentaire du Lagopède alpin (*Lagopus mutus pyrenaicus*) dans les Pyrénées Occidentales. 2 - printemps-été-automne. *Acta Biologica Montana* 10: 11-23.
- Boudoint, Y. (1976). Techniques de vol et de cassage d'os chez le Gypaète barbu (*Gypaetus barbatus*). *Alauda* 44 (1): 1-21.
- Boudoint, Y., Brosset, A., Bureau, L., Guichard, G. & Mayaud, N. (1953). Étude de la biologie du Circaète Jean le Blanc. *Alauda* 21: 86-127.
- Bouet, G. (1955). *Oiseaux de l'Afrique Tropicale*. (Première partie). Office de la Recherche Scientifique et Technique Outre-Mer, Paris.
- Boulton, R. & Rand, A.L. (1952). A collection of birds from Mount Cameroon. *Fieldiana Zool.* 34: 35-64.
- Bourne, G.R. (1985a). Field tests of micropatch and prey-size selection by Snail Kites (*Rostornis sociabilis*). *Ibis* 127(2): 141-147.
- Bourne, G.R. (1985b). The role of profitability in Snail Kite foraging. *J. Anim. Ecol.* 54: 697-709.
- Bourguin, O. (1980). *Biology of the Quail (Coturnix coturnix Linnaeus)*. PhD dissertation, University of Natal-Pietermaritzburg.
- Bouvet, F. (1985). The status of Bearded Vulture in Corsica. Pp. 129-130 in: Newton & Chancellor (1985).
- Bouvet, F. & Thibault, J.C. (1980). Distribution, reproduction, and history of the Osprey in Corsica. *Alauda* 4: 171-181.
- Bowen, D.E. (1971). *A Study of Dummy Nests and Greater Prairie Chicken (Tympuchus cupido pinnatus) Nests in Northeastern Kansas with Notes on Female Nesting Behavior*. MSc thesis, Kansas State University, Manhattan.
- Bowen, W.W. (1930). The relationships and distribution of the Bare-throated Francolins (*Pternistes*). *Proc. Acad. Nat. Sci. Philadelphia* 82: 149-164.
- Bowler, J. & Taylor, J. (1989). An annotated checklist of the birds of Manusela National Park. Seram (birds recorded on the Operation Raleigh Expedition). *Kukila* 4(1-2): 3-29.
- Bowles, J.H. (1930). Nesting of the Sharp-shinned Hawk. *Murrelet* 11: 13-14.
- Bowman, T.J. & Robel, R.J. (1977). Brood break-up, dispersal, mobility, and mortality of juvenile Prairie Chickens. *J. Wildl. Manage.* 41: 27-34.
- Boyce, D.A. (1980). Hunting and prenesting behavior of the Orange-breasted Falcon. *J. Raptor Res.* 14(2): 35-39.
- Boyce, D.A. (1985). Prairie Falcon prey in the Mojave Desert, California. *J. Raptor Res.* 19: 128-134.
- Boyce, D.A. & Kiff, L.F. (1981). Have the eggs of the Orange-breasted Falcon (*Falco deiroleueus*) been described? *J. Raptor Res.* 15(3): 89-93.
- Boyce, D.A. & Wiute, C.M. (1987). Evolutionary aspects of kestrel systematics: a scenario. Pp. 1-21 in: Bird & Bowman (1987).
- Boyce, D.A., Garrett, R.L. & Walton, B.J. (1986). Distribution and density of Prairie Falcons nesting in California during the 1970's. *J. Raptor Res.* 20: 71-74.
- Boyce, M.S. (1990). The Red Queen visits Sage Grouse leks. *Amer. Zool.* 30: 263-270.
- Boyce, M.S. & Tate, J. (1979). *A Bibliography of the Sage Grouse (Centrocercus urophasianus)*. Science Monograph 38. University of Wyoming Agricultural Experiment Station.
- Bradbury, W.C. (1915). Notes on the nesting of the White-tailed Ptarmigan in Colorado. *Condor* 17: 214-222.
- Bradley, M. & Oliphant, L.W. (1991). The diet of Peregrine Falcons in Rankin Inlet, Northwest Territories: An unusually high proportion of mammalian prey. *Condor* 93: 193-197.
- Bradshaw, R.H. (1992). Describing social order in laying hens. *J. World Pheasant Assoc.* 15-16: 81-92.
- Bragin, Ye.A. (1983). [Ecology of the Imperial Eagle in insular forests of the Kustanai Steppe]. Pp. 92-97 in: [Conservation of Birds of Prey]. Moscow. In Russian.
- Bragin, Ye.A. (1987). [Imperial Eagle]. Pp. 55-125 in: [Eagles]. Rare and endangered animals of Kazakhstan Series. Kainar Publishers, Alma-Ata. In Russian.
- Brailion, B. (1979). Le Pernoctère dans les Pyrénées françaises. Pp. 319-329 in: *La Grande Faune Pyrénéenne et des Montagnes d'Europe*. Laboratoire d'Études du Milieu Montagnard, University of Pau, France.
- Braine, J. & Braine, S.G. (1970). Two francolin species laying in one nest. *Ostrich* 41: 263.
- Branson, R. (1965). *Factors Affecting Dispersion of Ruffed Grouse During Late Winter and Spring on the Cloquet Forest Research Center, Minnesota*. PhD thesis, University of Minnesota, Minneapolis.
- Brander, R.B. (1967). Movements of female Ruffed Grouse during the mating season. *Wilson Bull.* 79: 28-36.
- Brandt, R. (1991). *Malleefowl Mound Distribution and Status in an area of the Murray Mallee of South Australia: a Baseline Report*. Nature Conservation Society of South Australia.
- Brannon, J.J. (1980). *The Reproductive Ecology of a Texas Harris Hawk (Parabuteo unicinctus harrisi) population*. MSc dissertation, University of Texas, Austin.
- Braun, C.E. (1969). *Population Dynamics, Habitat and Movements of White-tailed Ptarmigan in Colorado*. PhD dissertation, Colorado State University, Fort Collins.
- Braun, C.E. (1985). Biological investigations of White-tailed Ptarmigan in Colorado, USA, a review. Pp. 131-147 in: Lovel & Hudson (1985).
- Braun, C.E. & Rogers, G.E. (1971). *The White-tailed Ptarmigan in Colorado*. Colorado Division of Game, Fish and Parks Technical Publication 27.

- Braun, C.E. & Willers, W.B. (1967). The helminth and protozoan parasites of North American grouse (family: Tetraonidae): a checklist. *Avian Diseases* 11: 170-187.
- Braun, C.E., Britt, T. & Wallestad, R.O. (1977). Guidelines for maintenance of Sage Grouse habitats. *Wildl. Soc. Bull.* 5: 99-106.
- Braun, C.E., Hoffman, R.W. & Rogers, G.E. (1976). *Wintering Areas and Winter Ecology of White-tailed Ptarmigan in Colorado*. Colorado Division of Game, Fish and Parks, Special Report 38.
- Braun, C.E., Martin, K. & Robb, L.A. (1993). White-tailed Ptarmigan (*Lagopus leucurus*). No. 30 in: Poole & Gill (1993).
- Braun, C.E., Nish, D.H. & Giesen, K.M. (1978). Release and establishment of White-tailed Ptarmigan in Utah. *Southwestern Naturalist* 23: 661-668.
- Braun, C.E., Schmidt, R.K. & Rogers, G.E. (1973). Census of Colorado White-tailed Ptarmigan with tape recorded calls. *J. Wildl. Manage.* 37: 90-93.
- Brazili, M.A. (1986). Sea Eagle sunrise. *BBC Wildlife* 4(12): 588-592.
- Brazili, M.A. (1991). *The Birds of Japan*. Christopher Helm, London.
- Brazil, M.A. (1992). The birds of Shuangtaizhekou National Nature Reserve, Liaoning Province, China. *Forktail* 7: 91-124.
- Brazil, M.A. & Hanawa, S. (1991). The status and distribution of diurnal raptors in Japan. Pp. 175-238 in: Chancellor & Meyburg (1991).
- Bregulla, H.L. (1992). *Birds of Vanuatu*. Anthony Nelson, Oswestry, UK.
- Brehm, A.F. (1861). Etwas über die Adler. Ber. XIII. *Vers. orn. Ges. Stuttgart*: 55-62.
- Brennan, L.A. (1985). Mountain Quail habitat ecology study: final report. *Covey Rise* 4: 4.
- Brennan, L.A. (1990). What happened to the Mountain Quail in Idaho? *Quail Unlimited* 9: 42-43, 69.
- Brennan, L.A. (1991a). Regional tests of a Mountain Quail habitat model. *Northwestern Naturalist* 72: 100-108.
- Brennan, L.A. (1991b). How can we reverse the Northern Bobwhite population decline? *Wildl. Soc. Bull.* 19: 544-555.
- Brennan, L.A. & Block, W.M. (1985). Sex determination of Mountain Quail reconsidered. *J. Wildl. Manage.* 49: 475-476.
- Brennan, L.A. & Block, W.M. (1986). Line transect estimates of Mountain Quail density. *J. Wildl. Manage.* 50: 373-377.
- Brennan, L.A., Block, W.M. & Gutiérrez, R.J. (1985). Mountain Quail habitat ecology study: final report. *Covey Rise* 4: 4.
- Brennan, L.A., Block, W.M. & Gutiérrez, R.J. (1986). The use of multivariate statistics for developing habitat suitability index models. Pages 117-181 in: Verner, J., Morrison, M.L. & Ralph, C.J. eds. (1986). *Wildlife 2000: Modeling Habitat Relationships of Terrestrial Vertebrates*. University of Wisconsin Press, Madison.
- Brennan, L.A., Block, W.M. & Gutiérrez, R.J. (1987). Habitat use by Mountain Quail in northern California. *Condor* 89: 66-74.
- Bretagnolle, V. & Thibault, J.C. (1993). Communicative behavior in breeding ospreys: description and relationship of signals to life history. *Auk* 110: 736-752.
- Brewer, L.W. (1980). *The Ruffed Grouse in Western Washington*. Biological Bulletin 16. Washington State Department of Game.
- Brewster, C. (1991). Birds of the Gumaré area, northwest Botswana. *Babbler* 21(2): 12-61.
- Brickhill, J.G. (1982). Distribution and abundance of Malleefowl in New South Wales. In: *Abstracts of the Royal Australasian Ornithologists' Union Congress, Armidale 27-28 November 1982*.
- Brickhill, J.G. (1984). Malleefowl: a remarkable bird with an uncertain future. *Austr. Nat. Hist.* 21: 147-151.
- Brickhill, J.G. (1985). An aerial survey of nests of Malleefowl *Leipoa ocellata* Gould (Megapodidae) in central New South Wales. *Austr. Wildl. Res.* 12: 257-261.
- Brickhill, J.G. (1987a). Breeding success of Malleefowl *Leipoa ocellata* in central New South Wales. *Emu* 87: 42-45.
- Brickhill, J.G. (1987b). *The Conservation Status of the Malleefowl in New South Wales*. M. Nat. Res. Thesis. University of New England, Armidale, New South Wales.
- Brickhill, T. (1991). An observation of fledgling Red Goshawks. *Austr. Bird Watcher* 14: 32-33.
- Bridgman, C.L. (1993). First record of a nesting Mikado Pheasant in the wild. *J. World Pheasant Assoc.* 17 & 18: 57-61.
- Briggs, M.A. (1954). *Taxonomy and Distribution of the Birds of Oaxaca, Mexico*. MSc thesis. University of Florida, Gainesville.
- Brinker, D.F. & Erdman, T.C. (1985). Characteristics of autumn Red-tailed Hawk migration through Wisconsin. Pp. 107-136 in: Harwood, M. ed. 1985 *Proceedings of the Fourth Migration Conference*. Migration Association of North America, Rochester, N.Y.
- Brise, P. (1986-1988). Some unusual observations from the Piedmont. *Oriole* 51(2-3): 42-43.
- Brittas, R. (1984). Seasonal and yearly changes in condition of the Swedish Willow Grouse *Lagopus lagopus*. *Finnish Game Rev.* 42: 5-17.
- Brittas, R. (1988). Nutrition and reproduction of the Willow Grouse (*Lagopus lagopus*) in central Sweden. *Ornis Scand.* 19: 49-57.
- Brittas, R. & Marstrom, V. (1982). Studies in Willow Grouse *Lagopus lagopus* of some possible measures of condition in birds. *Ornis Fenn.* 59: 157-169.
- Brittas, R. & Willebrand, T. (1991). Nesting habitats and egg predation in Swedish Black Grouse. *Ornis Scand.* 22: 261-263.
- Brittas, R., Marstrom, V., Kenward, R.E. & Karlsson, M. (1992). Survival and breeding success of reared and wild Ring-necked Pheasants in Sweden. *J. Wildl. Manage.* 56(2): 368-376.
- Britton, P.L. ed. (1980). *Birds of East Africa. Their Habitat, Status and Distribution*. East African Natural History Society, Nairobi, Kenya.
- Britton, P.L. & Sugg, M.S.J. (1973). Birds recorded on Kilimilili track, Mt Elgon, Kenya. *J. East Afr. Nat. Hist. Soc. & Natl. Mus.* 143: 1-7.
- Brodie, E.D. & Baness, E.A. (1993). Food habits of nesting Great Black Hawks in Tikal National Park, Guatemala. *Biotropica* 25(3): 349-352.
- Brodtkorb, P. (1942). The chachalaca of interior Chiapas. *Proc. Biol. Soc. Washington* 55: 181-182.
- Brodtkorb, P. (1943). Birds from the gulf lowlands of southern Mexico. *Misc. Publ. Mus. Zool. Univ. Mich.* 55: 26-27.
- Brodtkorb, P. (1948). [Taxonomy of *Heptatheres chachinimus*]. *Auk* 65: 406-410.
- Brodtkorb, P. (1964). Catalogue of fossil birds. Part 2 (Anseriformes through Galliformes). *Bull. Florida State Mus. Nat. Sci.* 8: 195-335.
- Brodsky, L.M. (1988). Ornament size influences mating success in male Rock Ptarmigan. *Anim. Behav.* 36: 662-667.
- Broekhuysen, G.J. & Siegfried, W.R. (1970). Age and moult in the Steppe Buzzard in southern Africa. *Ostrich* 41(Suppl.): 223-237.
- Bronzini, E. (1943). [Captive breeding: *Circus fasciatus*]. *Riv. ital. Orn.* 13: 80-83.
- Bronzini, E. (1946). Riproduzione in cattività *Penelope "superciliosa"* (= *jacinca*). *Riv. ital. Orn.* 16: 51-55.
- Brooke, M. de L. (1988). The Ornithological Significance of the Viroin area, Santander, Colombia, with Special Reference to the Gorged Wood-quail (*Odonotophorus streptopus*). Unpublished Report to the International Council for Bird Preservation, Cambridge, UK.
- Brooke, R.K. (1971a). Breeding and breeding season notes on the birds of the Mzimba and adjacent low-lying areas of Mozambique. *Ann. Natal Mus.* 21: 55-69.
- Brooke, R.K. (1971b). Breeding seasons of Rhodesian francolins. *Honeyguide* 67: 18-19.
- Brooke, R.K. (1972). Rhodesian habitat of Dickinson's Kestrel. *Honeyguide* 70: 29.
- Brooke, R.K. (1974). The migratory Black Kite *Milvus migrans migrans* (Aves: Accipitridae) of the Palearctic in southern Africa. *Durban Mus. Novit.* 10: 54-66.
- Brooke, R.K. (1975). The taxonomic relationship of *Buteo rufifasciatus* and *Buteo augur*. *Bull. Brit. Orn. Club* 95: 152-154.
- Brooke, R.K. (1979). Tool using by the Egyptian Vulture to the detriment of the Ostrich. *Ostrich* 50: 119-120.
- Brooke, R.K. (1984). *Smith's Open Red Dang-Bong*. *Braz.* South African National Scientific Programmes Report 97. Council for Scientific and Industrial Research, Pretoria.
- Brooke, R.K. & Clancey, P.A. (1981). The authorship of the genera and specific names of the Bat Hawk. *Bull. Brit. Orn. Club* 101: 371-372.
- Brooke, R.K. & Hodgson, C.J. (1971). Winter food of the Secretarybird as revealed by pellets. *Bull. Brit. Orn. Club* 91: 121-125.
- Brooke, R.K. & Howells, W.W. (1971). Falcons at Brichenough Bridge, Rhodesia. *Ostrich* 42: 142-143.
- Brooke, R.K. & Jeffery, R.D. (1972). Observations on the biology of *Gypohierax angolensis* in western Angola. *Bull. Brit. Orn. Club* 92: 15-21.
- Brooke, R.K., Grobler, J.H., Irwin, M.P.S. & Steyn, P. (1972). A study of the migratory eagles *Aquila nipalensis* and *A. pomarina* (Aves, Accipitridae) in southern Africa, with comparative notes on other large raptors. *Pap. Nat. Mus. Rhodes.* 55(2): 61-114.
- Brooke, R.K., Martin, R., Martin, J. & Martin, E. (1980). The Boxed Eagle, *Hieraquetus pennatus*, is a breeding species in South Africa. *Geygus* 70: 297-304.
- Brooker, M.G. (1974). Field observations of the behaviour of the Wedge-tailed Eagle. *Emu* 74: 39-42.
- Brooker, M.G. (1983). Further food items of the Wedge-tailed Eagle. *Austr. Birds* 17: 63.
- Brooker, M.G. & Ridpath, M.G. (1980). The diet of the Wedge-tailed Eagle, *Aquila audax*, in Western Australia. *Austr. Wildl. Res.* 7: 433-454.
- Brookes, G.B. (1919). Report on investigations in regard to the spread of prickly-pear by the Scrub Turkey. *Queensland Agric. J.* 11: 26-28.
- Brooks, A. (1933). Some notes on the birds of Brownsville, Texas. *Auk* 50: 59-63.
- Broome, L.S., Bishop, K.D. & Anderson, D.R. (1984). Population density and habitat use by *Megapodius newtoni* in West New Britain. *Austr. Wildl. Res.* 11: 161-171.
- Brosset, A. (1961). Ecologie des oiseaux du Maroc oriental. *Trans. Inst. Scient. Chérif. série Zool.* 22: 155 pp.
- Brosset, A. (1969). Le comportement prédateur de l'épervier tropical *Accipiter toussenoti*. *Bull. Gabonaise* 5: 275-282.
- Brosset, A. (1971). Premières observations sur la reproduction de six oiseaux Africains. *Alauda* 39: 112-126.
- Brosset, A. (1973). Evolution des *Accipiter* forestières de l'est du Gabon. *Alauda* 41: 185-201.
- Brosset, A. (1974). La nidification des oiseaux en forêt Gabonaise: Architecture, situation des nids et prédation. *Rev. Ecol. (Terre Vie)* 28: 579-610.
- Brosset, A. (1977). Synchronisation du rythme des années chez l'épervier tropical *Accipiter melanoleucus*. *Oiseau et RFO* 47: 345-350.
- Brosset, A. & Erard, C. (1986). *Les Oiseaux des Régions Forestières du Nord-est du Gabon*. Vol. 1. Ecologie et comportement des espèces. Société Nationale de Protection de la Nature, Paris.
- Brosset, A. (1986). Les populations du Faucon Pelerin *Falco peregrinus* Gmelin en Afrique du Nord: un puzzle zoogéographique. *Alauda* 54: 1-14.
- Brothers, S. (1975). The Secretary Bird. *E. Cape Naturalist* 54: 14-19.
- Brouwer, J. & Garnett, S.T. eds. (1990). *Threatened Birds of Australia. An Annotated List*. RAOU Report 68. Royal Australasian Ornithologists' Union.
- Brown, A. (1986). *Autoecología de Bromelídeas Epífitas y su Relación con Cebus apella (Primates) en el Noroeste Argentino*. PhD thesis. Facultad de Ciencias Naturales, Universidad Nacional de la Plata.
- Brown, B.T. (1988). Additional Bald Eagle nesting records from Sonora, Mexico. *J. Raptor Res.* 22: 40-32.
- Brown, C.J. (1982). The Palm-nut Vulture in Maputland. *Afr. Wildl.* 36: 140-141.
- Brown, C.J. (1985a). *Bearded Vulture Research in the Sava and Lesotho Drakensberg Line*. The Endangered Wildlife Trust.
- Brown, C.J. (1985b). The status and conservation of the Cape Vulture in SWA/Namibia. *Vulture News* 14: 4-15.
- Brown, C.J. (1986a). Aspects of the biology of the Gabar Goshawk in Namibia. *Gabar* 1: 45-50.
- Brown, C.J. (1986b). Biology and conservation of the Lappet-faced Vulture in SWA/Namibia. *Vulture News* 16: 10-20.
- Brown, C.J. (1988a). Home range of Black Eagles in the Natal Drakensberg. *S. Afr. J. Wildl. Res.* 18: 120-125.
- Brown, C.J. (1988b). Scavenging raptors on farmlands: what is their future? *Afr. Wildl.* 42: 103-105.
- Brown, C.J. (1988c). A Study of the Bearded Vulture *Gypaetus barbatus* in Southern Africa. PhD thesis. University of Natal.
- Brown, C.J. (1988d). Greater Kestrel and Red-necked Falcon populations in the Gushu Region of the central Namib Desert. *Gabar* 3: 21-25.
- Brown, C.J. (1989a). Plumages and measurements of the Bearded Vulture in southern Africa. *Ostrich* 60: 165-171.
- Brown, C.J. (1989b). Pygmy Falcon population in the central Namib desert. *Namibia, Gabar* 4: 10-13.
- Brown, C.J. (1990a). An evaluation of supplementary feeding for Bearded Vulture and other avian scavengers in the Natal Drakensberg. *Lammergeier* 41: 30-36.
- Brown, C.J. (1990b). Breeding biology of the Bearded Vulture in Southern Africa. Part I: The pre-laying and incubation periods. Part II: The nestling period. Part III: The post-nesting dependence period. *Ostrich* 61: 24-32, 33-42, 43-49.
- Brown, C.J. (1991a). An investigation into the decline of the Bearded Vulture *Gypaetus barbatus* in Southern Africa. *Biol. Conserv.* 57(3): 315-338.
- Brown, C.J. (1991b). Declining Martial *Polemus bellicosus* and Tawny *Aquila rapax* Eagle populations and causes of mortality on farmlands in central Namibia. *Biol. Conserv.* 56: 49-62.
- Brown, C.J. & Bruton, A.G. (1991). Plumage colour and feather structure of the Bearded Vulture (*Gypaetus barbatus*). *J. Zool. London* 223 (4): 627-640.
- Brown, C.J. & Cooper, T.G. (1987). The status of cliff-nesting raptors on the Waterberg, SWA/Namibia. *Madroga* 15: 243-249.
- Brown, C.J. & Hines, C.J.H. (1987). Western Banded Snake Eagles in Namibia. *Gabar* 2: 40-42.
- Brown, C.J. & Piper, S.E. (1988). Status of Cape Vultures in the Natal Drakensberg and their cliff site selection. *Ostrich* 59: 126-136.
- Brown, C.J. & Plug, I. (1990). Food choice and diet of the Bearded Vulture *Gypaetus barbatus* in southern Africa. *S. Afr. J. Zool.* 25(3): 169-177.
- Brown, C.J., Brown, S.E. & Guy, J.J. (1988). Some physical parameters of Bearded Vulture *Gypaetus barbatus* nest sites in southern Africa. Pp. 139-152 in: *Proc. VI Pan Afr. Orn. Congr.*
- Brown, C.J., Paxton, M.W. & Henrichsen, I. (1987). Aspects of the biology of the Greater kestrel in SWA/Namibia. *Madroga* 15: 146-156.
- Brown, C.P. (1944). Food of Maine Ruffed Grouse by seasons and cover types. *J. Wildl. Manage.* 10: 17-28.
- Brown, D.E. (1989). *Arizona goshawks*. University of Arizona Press and Arizona Game and Fish Department, Tucson.
- Brown, D.E. & Ellis, D.H. (1977). *Status Summary and Recovery Plan for the Masked Bobwhite*. US Fish and Wildlife Service, Albuquerque, New Mexico.
- Brown, D.E. & Gutiérrez, R.J. (1980). Sex ratios, sexual selection, and sexual dimorphism in quails. *J. Wildl. Manage.* 44: 198-202.
- Brown, D.E. & Smith, R.H. (1980). Winter-spring precipitations and population levels of Blue Grouse in Arizona. *Wildl. Soc. Bull.* 8: 136-141.
- Brown, L.H. (1952). On the biology of the large birds of prey of the Embu District, Kenya Colony. *Ibis* 94: 577-620.
- Brown, L.H. (1953). On the biology of the large birds of prey of the Embu District, Kenya Colony. *Ibis* 95: 74-114.
- Brown, L.H. (1955). Supplementary notes on the biology of the large birds of prey of the Embu District, Kenya Colony. *Ibis* 97: 38-64, 183-221.
- Brown, L.H. (1966). Observations on some Kenya eagles. *Ibis* 108: 531-572.
- Brown, L.H. (1969). A first breeding record for the Southern Banded Snake Eagle *Circus fasciatus* in Kenya. *Ibis* 111: 390-391.
- Brown, L.H. (1970a). *African Birds of Prey*. Collins, London.
- Brown, L.H. (1970b). Recent new breeding records from Kenya. *Bull. Brit. Orn. Club* 90: 2-6.
- Brown, L.H. (1971). The relations of the Crowned Eagle *Stephanopetris cornatus* and some of its prey animals. *Ibis* 113: 240-243.
- Brown, L.H. (1972a). Natural longevity in wild Crowned Eagles *Stephanopetris cornatus*. *Ibis* 114: 263-265.
- Brown, L.H. (1972b). The breeding biology of the African Hammer Hawk *Polyboroides typus* in Kenya. *Ostrich* 43: 169-175.
- Brown, L.H. (1974a). The races of the European Snake Eagle *Circus gallicus*. *Bull. Brit. Orn. Club* 94: 126-128.
- Brown, L.H. (1974b). Is poor breeding success a reason for the rarity of Ayres' Hawk Eagle? *Ostrich* 45: 145.
- Brown, L.H. (1974c). A record of two young reared by Verreaux's Eagle. *Ostrich* 45: 146.
- Brown, L.H. (1976a). *Birds of Prey. Their Biology and Ecology*. Hamlyn, London.
- Brown, L.H. (1976b). *Eagles of the World*. David & Charles, Newton Abbot, UK.
- Brown, L.H. (1976c). *British Birds of Prey*. New Naturalist Series. William Collins Sons & Co., London.
- Brown, L.H. (1977). The status, population structure, and breeding dates of the African Lammergeier *Gypaetus barbatus meridionalis*. *J. Raptor Res.* 11: 49-58.
- Brown, L.H. (1980). *The African Fish Eagle*. Purnell, Cape Town.
- Brown, L.H. (1982). The prey of the Crowned Eagle *Stephanopetris cornatus* in central Kenya. *Scopus* 6: 91-94.
- Brown, L.H. (1984). Systematics problems in African Falconiformes. Pp. 33-45 in: Ledger (1984).
- Brown, I. H. & Aradottir, D. (1988). *Eagle, Hawk, and Falcon*. World Scientific, Singapore.
- Brown, I. H. & Britton, P.L. (1980). *The Records, Significance, and Status of Birds in the East African Rift Valley*. Horns Society, Nairobi.
- Brown, I. H. & Brown, B.F. (1979). The behaviour of the Black Spotted Hawk *Accipiter melanoleucus*. *Ardea* 67: 4.
- Brown, I. H. & Orrell, G. (1968). A first breeding record of the Cuckoo Falcon in Kenya. *J. East Afr. Nat. Hist. Soc.* 27: 49-51.
- Brown, L.H. & Cade, T.J. (1972). Age classes of the Baieir and African Fish Eagle. *Ostrich* 43: 1-16.
- Brown, L.H. & Davey, P.B.A. (1978). Natural longevity in Ayres' Eagle *Hieraquetus dubius*. *Balankester* 30: 27-31.
- Brown, L.H. & Hopcraft, J.B.D. (1973). Population structure and dynamics of the African Fish Eagle *Hieraquetus* found at Lake Natron. *Kenya J. Sci.* 11: 1-11.

- Brown, L.H. & Watson, A. (1964). The Golden Eagle in relation to its food supply. *Ibis* 106: 78-100.
- Brown, L.H., Garget, V. & Steyn, P. (1978). Breeding success in some African Eagles related to theories about sibling aggression and its effects. *Ostrich* 48: 65-71.
- Brown, L.H., Urban, E.K. & Newman, K. (1982). *The Birds of Africa*. Vol. 1. Academic Press, London & New York.
- Brown, M. (1987). Bald Eagle and Short-tailed Hawk prey on other raptors. *Florida Field Nat.* 15(1): 19-20.
- Brown, P.E. (1979). *The Scottish Osprey*. From Extinction to Survival. Heinemann, London.
- Brown, P.E. & Waterson, G. (1962). *The Return of the Osprey*. Collins, London.
- Brown, R.L. (1969). *Ecological Study of Merriam Quail*. Pp. 49-52 in: Job Progress Report in Wildlife Research in Arizona. Arizona Fish and Game, Phoenix.
- Brown, R.L. (1982). Effects of livestock grazing on Merriam Quail in southeastern Arizona. *J. Range Manage.* 35: 727-732.
- Brown, W.H. (1971). Winter population trends in the Red-shouldered Hawk. *Amer. Birds* 25: 813-817.
- Brown, W.H. (1976). Winter population trends in the Black and Turkey Vultures. *Amer. Birds* 30: 909-912.
- Browne, P.W.P. (1981). New bird species in Mauntana. *Malimbis* 3: 63-72.
- Browning, M.R. (1974). Comments on the winter distribution of the Swainson's Hawk (*Buteo swainsoni*) in North America. *Amer. Birds* 28: 865-867.
- Browning, M.R. (1977). The types and type-localities of *Oreorcyx pictus* (Douglas) and *Oryx plumiferus* (Gould). *Proc. Biol. Soc. Washington* 90: 808-812.
- Browning, M.R. (1979). Distribution, geographic variation and taxonomy of *Lagopus mutus* in Greenland and northern Canada. *Dan. Orn. Foren. Tidsskr.* 73: 29-40.
- Bruce, M.D. (1987). Additions to the birds of Wallacea. I. Bird records from smaller islands in the Lesser Sundas. *Aukula* 3(1-2): 38-44.
- Bruin, S. (1968). Original description of *Vultur trachelotus*: correction of citation. *Ostrich* 39: 196.
- Brüll, H. (1961). Birkwildforschung und Birkwildhege in Schleswig-Holstein. *Zeit. Jagdwiss.* 7: 104-126.
- Brüll, H. (1964). *Das Leben Deutscher Greifvögel*. 2. Aufl., Fischer, Stuttgart, Germany.
- Brüll, H. (1971). Studien am Birkwild im Beobachtungsrevier "Dellstedter Birkwildmoor" über 16 Jahre 1954-1969. *Zeit. Jagdwiss.* 1: 53-59.
- Brun, J.-C. & Aubineau, J. (1989). La reconstruction des populations de Perdrix rouges (*Alectoris rufa*) et grises (*Perdix perdix*) à l'aide d'oiseaux d'élevage. *Gibier Faune Sauvage* 6: 205-223.
- Brun, R. (1971). [Problems of ontogenesis and evolution in the feather pattern formation of the Argus Pheasant (*Argus argus*)]. *Rev. Suisse Zool.* 78: 115-134. In German, with English summary.
- Bruning, D. (1977). Breeding the Malay Peacock Pheasant at the New York Zoological Park. *Avicult. Mag.* 83: 61-62.
- Bruning, D. (1983a). Breeding condors in captivity for release into the wild. *Zoo Biology* 2: 245-252.
- Bruning, D. (1983b). Continued breeding success with Malay Peacock Pheasants *Polyplectron malacense malacense* at the New York Zoological Park. *J. World Pheasant Assoc.* 8: 62-68.
- Bruning, D. & Siti Hawa Yatim (1992). *International Studybook of the Rothschild Mountain Peacock Pheasant*. Polyplectron inopinatim. New York Zoological Society, USA.
- Brunn, B. (1981). The Lappet-faced Vulture in the Middle East. *Sundgrouse* 2: 91-95.
- Bruun, B., Mendelssohn, H. & Bull, J. (1981). A new subspecies of Lappet-faced Vulture *Torgos tracheliotus* from the Negev Desert, Israel. *Bull. Brit. Orn. Club* 101: 244-247.
- Bryant, J.P. & Kuropat, P.J. (1980). Selection of winter forage by subarctic browsing vertebrates: the role of plant chemistry. *Ann. Rev. Ecol. Syst.* 11: 261-285.
- Buchanan, J.B. (1988). North American Merlin populations: an analysis using Christmas Bird Count data. *Amer. Birds* 42: 1178-1180.
- Buchanan, J.B., Schick, C.T., Brennan, L.A. & Herman, S.G. (1988). Merlin predation on wintering Dunlins, hunting success, and Dunlin escape tactics. *Wilson Bull.* 100: 108-118.
- Bucher, E.H. (1980). Ecología de la fauna chaqueña. Una revisión. *Ecotar* 7: 111-159.
- Buchholz, R. (1989). *Singing Behavior and Ornamentation in the Yellow-knobbed Curassow* (Crax daubentoni). MSc thesis. University of Florida, Gainesville.
- Buchholz, R. (1990). The Yellow-knobbed Curassow in Venezuela. *World Pheasant Assoc. News* 29: 11, 13.
- Buchholz, R. (1991). Older males have bigger knobs: Correlates of ornamentation in two species of curassow. *Auk* 108: 153-160.
- Buchholz, R. (1992). Confusing models with tests in studies of sexual selection: Reply to Jones. *Auk* 109: 199-201.
- Buchholz, R. (1994). *Adaptive Functions of Fleshly Ornamentation in Wild Turkey and Related Birds*. PhD thesis. University of Florida, Gainesville.
- Buckley, P.A., Foster, M.S., Morton, E.S., Ridgely, R.S. & Buckley, F.G. (1985). *Neotropical Ornithology*. Ornithological Monographs 36. American Ornithologists' Union, Washington, D.C.
- Bucknell, J.A. & Chasen, F.N. (1990). *Birds of Singapore and South-East Asia*. Tynnon Press, Scotland.
- Buhrkempe, J.E., Edwards, W.R., Vance, D.R. & Westemeier, L. (1984). Effects of residual vegetation on Prairie Chicken nest placement and success. *Wildl. Soc. Bull.* 12: 382-386.
- Buhot, D. (1983). Deux mois d'observation d'un couple d'Aigles de Bonelli, *Hieraetus fasciatus* (Vieillot) en Israël. *Alauda* 51(2): 92-108.
- Buhni, D. (1989). Etho-ecologie comparée de l'Aigle de Bonelli *Hieraetus fasciatus*. Vieillot. *Alauda* 57(1): 71-75.
- Bulavin, A. (1933). [On the Biology of the Greater Spotted Eagle]. *Hunter and Fisher of Siberia* 9: 26. In Russian.
- Bullock, I. (1990). *Birds of the Republic of Seychelles*. Seychelles Ministry of Education & ICBP.
- Bump, G. (1958). Red-legged Partridges of Spain. US Fisheries and Wildlife Service, Special Scientific Report, Wildlife 39.
- Bump, G. & Bohl, W.H. (1961). *Red Junglefowl and Kalij Pheasants*. US Fish & Wildlife Service, Special Scientific Report, Wildlife 62.
- Bump, G. & Bump, J.W. (1964). A study and review of the Black Francolin and the Gray Francolin. US Fisheries and Wildlife Service, Special Scientific Report, Wildlife 81.
- Bump, G., Darrow, R.W., Edminster, F.C. & Crissey, W.F. (1947). *The Ruffed Grouse: Life History, Propagation, Management*. New York State Conservation Department, Hottel Press, Buffalo.
- Rundy, G. (1976). *The Birds of Libya*. BOU Checklist. British Ornithologists' Union, London.
- Bunnell, S.D., Rensel, J.A., Kimball, J.F. & Wolf, M.J. (1977). Determination of age and sex of dusky Blue Grouse. *J. Wildl. Manage.* 41: 662-666.
- Burger, J. (1974). Breeding biology and ecology of the Brown-hooded Gull. *Auk* 91: 601-613.
- Burger, L.W. (1993). *Survival and Reproductive Ecology of Northern Bobwhite in Northern Missouri*. PhD thesis. University of Missouri, Columbia.
- Burger, L.W., Kurzejeski, E.W., Dailey, T.V. & Ryan, M.R. (1990). Structural characteristics of vegetation in CRP fields in northern Missouri and their suitability as Bobwhite habitat. *Trans. North Amer. Wildl. Nat. Resour. Conf.* 55: 74-83.
- Burnham, A. & Mattox, W.G. (1984). Biology of the Peregrine and Gyrfalcon in Greenland. *Médl. Grønland* 14: 1-30.
- Burnham, W.A., Jenny, J.P. & Turley, C.W. eds. (1989). *Maya Project: Use of Raptors as Environmental Indicators for Design and Management of Protected Areas and for Building Local Capacity for Conservation in Latin America*. Progress Report II. 1989. The Peregrine Fund, Inc., Boise, Idaho.
- Burnham, W.A., Whitacre, D.F. & Jenny, J.P. eds. (1990). *Maya Project: Use of Raptors as Environmental Indicators for Design and Management of Protected Areas and for Building Local Capacity for Conservation in Latin America*. Progress Report III. 1990. The Peregrine Fund, Inc., Boise, Idaho.
- Burns, F.L. (1911). A monograph of the Broad-winged Hawk (*Buteo platypterus*). *Wilson Bull.* 23: 139-320.
- Burt, J. & Young, L. (1988). Observations on chick-rearing methods for re-introduction programmes. *J. World Pheasant Assoc.* 13: 32-41.
- Burton, A.M. (1991). *Resource Partitioning Between Two Sympatric Goshawks in the Australian Wet Tropics*. PhD thesis. James Cook University, Townsville, Australia.
- Burton, A.M. (1993). Cannibalism at a Brown Goshawk nest. *Austr. Bird Watcher* 15: 45.
- Burton, A.M., Alford, R.A. & Young, J. (1994). Reproductive parameters of the Grey Goshawk (*Accipiter novaehollandiae*) and Brown Goshawk (*Accipiter fasciatus*) at Abergowrie, northern Queensland, Australia. *J. Zool., London* 232: 347-363, 525-538.
- Burton, P. & Hoyer, T. (1989). *Birds of Prey*. Gallery Books, New York.
- Burton, P.J.K. (1978). The intertarsal joint of the harrier-hawks, *Polyborus* spp. and the Crane-Hawk *Geranoastur carolinensis*. *Ibis* 120: 171-177.
- Burtulin, S.A. (1974). On the geographical distribution of the true pheasants (genus *Phasianus* sensu stricto). *Ibis* Ser. 8 no. 4: 337-414.
- Burtulin, S.A. (1988). Additional notes on the true pheasants (*Phasianus*). *Ibis* Ser. 9 no. 2: 570-92.
- Busch, D.F., Degraw, W.A. & Clumppitt, N.C. (1978). Effects of handling-disturbance stress on heart rate in the Ferruginous Hawk (*Buteo regalis*). *J. Raptor Res.* 12: 122-125.
- Bursk, W.H. & Lechman, M. (1978). Endoparasites of the Swallow-tailed Kite in Costa Rica. *Vol. 98(4)*: 767-768.
- Bustamante, J. (1990). *Condiciones Ecológicas del Periodo de Emancipación en Falconiformes*. PhD thesis. Universidad Autónoma de Madrid, Spain.
- Bustamante, J. (1993). Post-fledging dependence period and development of flight and hunting behaviour in the Red Kite *Milvus milvus*. *Bird Study* 40(3): 181-188.
- Bustamante, J. & Hiraldo, F. (1989). Post-fledging dependence period and maturation of flight skills in the Black Kite (*Milvus migrans*). *Bird Study* 36: 199-204.
- Bustamante, J. & Hiraldo, F. (1990). Factors influencing family rupture and parent-offspring conflict in the Black Kite *Milvus migrans*. *Ibis* 132: 58-67.
- Bustamante, J. & Hiraldo, F. (1993). The function of aggressive phases by breeding Black and Red Kites *Milvus migrans* and *M. milvus* during the post-fledging dependence period. *Ibis* 135: 139-147.
- Butchart, D. (1989). Some notes on the Palmnut Vulture in northern Zululand. *Vulture News* 21: 22-24.
- Butler, A.L. (1899). The Birds of the Andaman and Nicobar Islands. *J. Bombay Nat. Hist. Soc.* 12: 684-690.
- Butler, T.Y. (1979). *The Birds of Ecuador and the Galapagos Archipelago*. The Ramphastos Agency, Portsmouth, NH.
- Button, J.A. (1965). Harlequin Quail at Llaro and Ibadan. *Bull. Nigerian Orn. Soc.* 6: 53.
- Butynski, T.M. & Kalina, J. (1988). First Rufous-chested Sparrowhawk breeding record for East Africa. *Gubar* 3: 94-98.
- Cabot, J. (1991). Distribution and habitat selection of *Buteo polysoma* and *Buteo poecliochrous* in Bolivia and neighboring countries. *Bull. Brit. Orn. Club* 111(4): 199-209.
- Cabot, J. & Serrano, P. (1986). Data on the distribution of some species of raptors in Bolivia. *Bull. Brit. Orn. Club* 106(4): 170-173.
- Cabot, J. & Serrano, P. (1988). Distributional data on some non-passerine species in Bolivia. *Bull. Brit. Orn. Club* 108: 187-193.
- Cabot, J., Castroviejo, J. & Urins, V. (1988). Cuatro nuevas especies de aves para Bolivia. *Doñana Acta Vertebrata* 15: 21-33.
- Cade, B.S. (1985). *Winter Habitat Preferences and Migration Patterns of Blue Grouse in Middle Park, Colorado*. MSc thesis. Colorado State University, Fort Collins.
- Cade, B.S. & Hoffman, R.W. (1990). Winter use of Douglas-fir forests by Blue Grouse in Colorado. *J. Wildl. Manage.* 54: 471-479.
- Cade, T.J. (1955). Variation of the Common Rough-legged Hawk in North America. *Condor* 57: 313-346.
- Cade, T.J. (1960). Ecology of the Peregrine and Gyrfalcon populations in Alaska. *Univ. Calif. Publ. (Zool.)* 63: 151-290.
- Cade, T.J. (1968). The Gyrfalcon and falconry. *Living Bird* 7: 237-240.
- Cade, T.J. (1982). *The Falcons of the World*. Collins, London & Cornell University Press, Ithaca, NY.
- Cade, T.J. & Bird, D.M. (1990). Peregrine Falcons, *Falco peregrinus*, nesting in an urban environment: a review. *Canadian Field-Nat.* 104: 209-218.
- Cade, T.J. & Jones, C.G. (1993). Progress in restoration of the Mauritius Kestrel. *Conserv. Biol.* 7: 169-175.
- Cade, T.J., Anderson, J.H., Thelander, C.G. & White, C.M. eds. (1988). *Peregrine Falcon Populations: Their Management and Recovery*. The Peregrine Fund, Inc., Boise, ID.
- Cain, J.R., Beason, S.L., Rowland, L.O. & Rowe, L.D. (1982). The effects of varying dietary phosphorus on breeding Bobwhites. *J. Wildl. Manage.* 46: 1061-1064.
- Cain, J.R., Lein, R.J. & Beason, S.L. (1987). Phytoestrogen effects on reproductive performance of Scaled Quail. *J. Wildl. Manage.* 51: 198-201.
- Calaby, J.H. (1951). Notes on the Little Eagle; with particular reference to rabbit predation. *Emu* 51: 33-56.
- Calchi, R. & Vilorio, A.L. (1991). Occurrence of the Andean Condor in the Perijá Mountains of Venezuela. *Wilson Bull.* 103(4): 720-722.
- Calderón, J., Castroviejo, J., García, L. & Ferrer, M. (1987). El Águila Imperial (*Aquila adalberti*) en Doñana: Algunos aspectos de su reproducción. *Alytes* 5: 47-72.
- Calderón, J., Castroviejo, J., García, L. & Ferrer, M. (1988). El Águila Imperial (*Aquila adalberti*) en Doñana: dispersión de los jóvenes, estructura y mortalidad. *Doñana Acta Vertebrata* 15: 79-98.
- Calderón, J., Delibes, M. & Amores, F. (1977). Status y ecología del Águila Real ibérica (*Aquila chrysaetos*) en España. Pp. 705-719 in: *I Reunión Iberoamericana de Zoólogos de Vertebrados*. La Rábida.
- Calderón, J., González, L.M., González, J.L. & Hiraldo, F. (1984). Situación actual y problemática del Águila Imperial ibérica (*Aquila adalberti* Brehm, 1961) en España. Pp. 60-69 in: *CRPR (1984). Rapinayres Méditerranéens II*. Centre de Recerca i Protecció de Rapinayres, Barcelona, Spain.
- Caldwell, P.J. (1976). *Energetic and Population Considerations of the Sharp-tailed Grouse in the Aspen Parkland of Canada*. PhD thesis. Kansas State University, Manhattan.
- Caleda, M.R. (1987). Preliminary investigation of the vegetative composition of a selected habitat of the Palawan Peacock Pheasant (*Polyplectron emphanum*, Temminck 1831). Unpublished report.
- Caleda, M.R. (1993). Population ecology of the Palawan Peacock-pheasant. In: Jenkins (1993).
- Caleda, M.R., Lanants, R. & Vilorio, E. (1986). Preliminary studies of the Palawan Peacock Pheasant. In: Ridley (1986a).
- Call, M.W. (1979). *Habitat Management Guides for Birds of Prey*. US Bur. Land Manage. Tech. Note T/N-338. Denver, CO.
- Camenzind, F.J. (1969). Nesting ecology and behaviour of the Golden Eagle. Nesting ecology of raptorial birds in central Utah. *Brigham Young Univ. Sci. Bull. (Biol. Ser.)* 10: 4-15.
- Cameron, A.C. (1974). Nesting of the Letter-winged Kite in western Queensland. *Sunbird* 5: 89-94.
- Cameron, A.C. (1976). Nesting of the Square-tailed Kite. *Sunbird* 7: 42-47.
- Cameron, A.C. (1992). Further notes on Square-tailed Kites nesting in south-east Queensland. *Sunbird* 22: 30-31.
- Cameron, M. & Olsen, P. (1993). Significance of caching in *Falco*: evidence from a nesting pair of Peregrine Falcons *Falco peregrinus*. In: Olsen (1993a).
- Campbell, B. (1934). Bird notes from southern Arizona. *Condor* 44: 57-65.
- Campbell, B. & Lack, E. eds. (1985). *A Dictionary of Birds*. T. & A. D. Poyser, Calton, England.
- Campbell, C.A. (1975). Ecology and reproduction of Red-shouldered Hawks in the Waterloo region, southern Ontario. *J. Raptor Res.* 9: 12-17.
- Campbell, D.K., Ferkovich, P.E. & Harris, B.K. (1973). Effects of hunting and some other environmental factors on Scaled Quail in New Mexico. *Wildl. Manage.* 34: 1-49.
- Campbell, H. (1957). Fall foods of Gambel's Quail (*Lophortyx gambelii*) in New Mexico. *Southwestern Naturalist* 2: 122-128.
- Campbell, H. (1968). Seasonal precipitation and Scaled Quail in eastern New Mexico. *J. Wildl. Manage.* 32: 641-644.
- Campbell, H. (1972). A population study of Lesser Prairie Chickens in New Mexico. *J. Wildl. Manage.* 36: 689-699.
- Campbell, H. & Harris, B.K. (1965). Mass dispersal and long distance movements in Scaled Quail. *J. Wildl. Manage.* 29: 801-805.
- Campbell, R.W., Dawe, N.K., McTaggart-Cowan, L., Cooper, J.M., Kaiser, G.W. & McNall, C.E. (1990). *The Birds of British Columbia*. Vol. II. Non-passerines. Royal British Columbia Museum, Victoria.
- Campbell-Kissack, L., Blankenship, L.H. & Stewart, J.W. (1985). Plant and animal foods of Bobwhite and Scaled Quail in southwestern Texas. *Southwestern Naturalist* 30: 543-553.
- Campbell-Kissack, L., Blankenship, L.H. & White, L.D. (1984). Grazing management impacts on quail during drought in the northern Rio Grande Plains, Texas. *J. Range Manage.* 37: 442-446.
- Campo, J.J., Swank, W.G. & Hopkins, C.R. (1989). Brood habitat use by Eastern Wild Turkeys in eastern Texas. *J. Wildl. Manage.* 53(2): 479-482.
- Canevari, M., Canevari, P., Carrizo, B.R., Harris, G., Mata, J.R. & Straneck, R.J. (1991). *Nuevo Guía de las Aves Argentinas*. Fundación Aelindar, Buenos Aires.
- Canevari, P. & Cuziani, S.M. (1988). Situación de la familia Cracidae en la República Argentina. Unpublished report presented at the 11 International Cracidae Symposium, Caracas, Venezuela, February/March 1988.
- Cannon, R.W. & Christensen, D.M. (1984). Breeding range and population status of the Greater Prairie Chicken in Missouri. *Trans. Missouri Acad. Sci.* 18: 33-39.
- Cannon, R.W. & Knopf, F.L. (1979). Lesser Prairie Chicken responses to range fires at the booming ground. *Wildl. Soc. Bull.* 7: 44-46.
- Cannon, R.W. & Knopf, F.L. (1981). Lack monitors as a trend index for prairie grouse populations. *J. Wildl. Manage.* 45: 776-778.
- Cano, A. & Parrinder, E.R. (1961). Studies of less familiar birds. Bonelli's Eagle. *British Birds* 54: 422-427.
- Cant, G. (1978). Eleonor's Falcon wintering in the Southern Aegean. *Nature-Hellenic Soc. Prot. Nature* (1978): 28-29.
- Canut, J. (1993). Tendència poblacional del Gall ferri *Tetrao urogallus* al Parc Nacional d'Aigüestortes i estany de Sant Maurici (Catalunya). Recomanacions per a la gestió de l'espècie a l'àmbit de l'espai protegit. (Summary: Poblacion trends of the Caraculine *Tetrao urogallus* in the Aiguessortes-Sant Maurici National Park, Cataluna NE Spain). Recomanacions for the management in the protected area). *Bull. Grup Català d'Aviologia* 10: 33-38. In Catalan with English summary.
- Canut, J., García, D., Heredia, R. & Marco, J. (1987a). Status, características ecológicas, recursos alimentarios y evolución del Quebrantahuesos (*Gypaetus barbatus*) en la vertiente sur de los Pirineos. *Acta Biologica Montana* 7: 83-99.
- Canut, J., García, D. & Marco, J. (1987b). Distribución y residencia ecológica de la Perdiz Nival *Lagopus mutus* en el Pirineo ibérico. *Acta Biologica Montana* 7: 51-56.

- Cardiff, S. & Rensen, J. (1981). Three bird species new to Bolivia. *Bull. Brit. Orn. Club* 101(2): 304-305.
- Cardwell, P. (1971). The mewing note of Swainson's Francolin. *Wivaltersand Bird Club News Sheet* 76(2).
- Carey, D.M. (1985). *Climatological and Environmental Factors Affecting the Foraging Behavior and Ecology of the Snail Kite (Rostrhamus sociabilis plumbeus Ridgway)*. MSc dissertation, University of Miami, Coral Gables, FL.
- Carlson, J. (1984). Observations sur le comportement de l'Aigle Boté *Hieraeetus pennatus*. *Aulauda* 52: 189-203.
- Carlson, J. (1992). Contribution à l'écologie de l'Aigle Boté *Hieraeetus pennatus*. *La Marie blanche, Dossiers de GEOB* 1: 1-21.
- Carlson, M. (1992). Retrieval and consumption of cached prey by the Merlin (*Falco columbarius*) outside the breeding season. *Dan. Orn. Foren. Tidsskr.* 86: 177-181.
- Carlyon, J. (1987). Two breeding records of the Cuckoo Hawk from the Transvaal, RSA. *Gahar* 2: 45-46.
- Carpenter, J., Yealand, J.J., van Bockstaele, R. & van den Bergh, W. (1975). Imperial Pheasant hybridization at the Antwerp Zoo. *Int. Zool. Yb.* 15: 100-5.
- Carr, H.D. (1967). *Effects of sage brush spraying on abundance, distribution and movements of Sage Grouse*. MSc thesis, Colorado State University, Fort Collins.
- Carriker, M.A. (1910). An annotated list of the birds of Costa Rica, including Cocos Island. *Ann. Carnegie Mus.* 6: 314-915.
- Carriker, M.A. (1934). Descriptions of new birds from Peru, with notes on the nomenclature and status of other little-known species. *Proc. Acad. Nat. Sci. Philadelphia* 85: 1-38.
- Carrillo, J. & Delgado, G. (1991). Threats to and conservationist aspects of birds of prey in the Canary Islands. Pp. 25-32 in: Chancellor & Meyburg (1991).
- Carroll, J.P. (1990). Monitoring reproduction and mortality in Galliformes. Pp. 153-166 in Hill et al. (1990).
- Carroll, J.P. (1992). A model of Gray Partridge *Pendix perdix* population dynamics in North Dakota. Pp. 337-349 in Birkan, Potts et al. (1992).
- Carroll, J.P., Church, K.E. & Kelsey, M.G. (1994). Status and conservation of neotropical quails. In: *Proceedings of the First International Wildlife Management Congress*.
- Carroll, J.P., Kuvlesky, W.P., Gail, S.A. & Salazar, E.G. (1994). Status of Mexican quails. *Trans. North Amer. Wildl. Nat. Resour. Conf.* 59.
- Carroll, R.W. (1988). Birds of the Central African Republic. *Mallinhus* 10(2): 177-200.
- Carter, D.L. & Wauer, R.H. (1965). Black Hawk nesting in Utah. *Condor* 67(1): 82-83.
- Carvalho, J.P. (1940). Criando Uns. *Chateaux et quintails* 61: 143.
- Casement, M.B. (1966). Migration across the Mediterranean observed by radar. *Ibis* 108: 461-491.
- Cassidy, J. (1990). *Book of North American Birds*. Reader's Digest.
- Castrale, J.S. (1991). Eastern woodland buteos. Pp. 50-59 in: *Proceedings Midwest Raptor Management Symposium and Workshop*, National Wildlife Federation, Washington, D.C.
- Castrovielo, J. (1967). Eine neue Auerhuhnrasse von der Iberischen Halbinsel. *J. Orn.* 108: 220-221.
- Castrovielo, J. (1975). *El Urogallo Tetrao urogallus, L. en España*. Monografías de la Estación Biológica de Donaña 3. Consejo Superior de Investigaciones Científicas, Madrid.
- Castrovielo, J., Delibes, M., García-Dory, M.A., Garzón, J. & Junco, E. (1974). Censo de Urogallos cantábricos. *Asturiana* 2: 53-74.
- Catlow, P. (1982). Displays of the Himalayan Monal *Lophophorus impeyanus* in captivity. *J. World Pheasant Assoc.* 7: 92-95.
- Catusse, M. (1988). *Contribution à l'étude Éco-éthologique de la Parade du Grand Tétraz dans les Pyrénées Centrales*. PhD thesis, Paul Sabatier University, Toulouse.
- Catusse, M. (1992). Ontogénèse du système de reproduction des mâles de Grand Tétraz observé sur une arène des Pyrénées centrales. *Aulauda* 60: 81-92.
- Catusse, M., Mothe, T. & Menoni, E. (1992). La Gélinotte des bois *Bonasa bonasia* existe dans les Pyrénées. *Aulauda* 60: 129-133.
- Cave, F.O. (1947). Note on Heuglin's Banded Francolin. *Bull. Brit. Orn. Club* 68: 3-7.
- Cave, F.O. (1949). Some notes on the Banded Francolin. *Francolinus schlegelii* Heuglin. *Bull. Brit. Orn. Club* 69: 103-104.
- Cavé, A.J. (1968). The breeding of the Kestrel, *Falco tinnunculus* L., in the reclaimed area Oostelijk Flevoland. *Netherlands. J. Zool.* 18: 313-407.
- Caviglia, L. (1981). Situación sobre los cráneos en Uruguay. Pp. 190-191 in: Estudillo López (1981).
- Cawkwell, E.M. & Hamilton, J.E. (1961). The birds of the Falkland Islands. *Ibis* 103A: 1-27.
- Cayford, J.T. & Walker, F. (1991). Counts of male Black Grouse *Tetrao tetrix* in North Wales. *Bird Study* 38: 80-86.
- Caziani, S.M. & Protomastro, J.J. (1988). The fruit availability and consumption by *Ortalis canicollis* in the Argentine Chaco. Unpublished report presented at the II International Cracid Symposium, Caracas, Venezuela, February/March 1988.
- Caziani, S.M. & Protomastro, J.J. (1994). Diet and fruit-eating habits of the Chaco Chachalaca. *Wilson Bull.* 106.
- Ceballos, O. & Donazar, J.A. (1989a). Actividad, uso del espacio y cuidado parental en una pareja de alimoches (*Neophron percnopierus*) durante el período de dependencia de los pollitos. *Ecología* 2: 275-291.
- Ceballos, O. & Donazar, J.A. (1989b). Factors influencing the breeding density and nest-site selection of the Egyptian Vulture (*Neophron percnopterus*). *J. Orn.* 130(3): 353-359.
- Ceballos, O. & Donazar, J.A. (1990a). Parent-offspring conflict during the post-fledging period in the Egyptian Vulture *Neophron percnopterus* (Aves, Accipitridae). *Ethology* 85: 225-235.
- Ceballos, O. & Donazar, J.A. (1990b). Roost-tree characteristics, food habits and seasonal abundance of roosting Egyptian Vultures in northern Spain. *J. Raptor Res.* 24: 19-25.
- Cely, J.E. (1979). Status of the Swallow-tailed Kite and factors affecting its distribution. Pp. 144-150 in: Forsythe, D.M. & Ezell, W.B. eds. (1979). *First South Carolina Endangered Species Symposium*. Columbia, SC: South Carolina Wildlife and Marine Resources Department.
- Cely, J.E. (1987). American Swallow-tailed Kite uses Mississippi Kite nest. *J. Raptor Res.* 21(3): 124.
- Cely, J.E. & Sorrow, J.A. (1990). *The American Swallow-tailed Kite in South Carolina*. Nongame and Heritage Trust Publ. 1. South Carolina Wildlife and Marine Resources Department, Columbia, South Carolina.
- Césari, C. & Domínguez Alonso, P. (1974). Presencia en el Delta bonaerense de la Pava de Monte Común. *Penelope obscura obscura* Temminck. *Hornero* 11: 307-308.
- Chambers, S. (1989). *Birds of New Zealand. Locality Guide*. Aran Books, Hamilton, New Zealand.
- Chamrad, A.D. & Duo, J.D. (1973). Prescribed burning and grazing for Prairie-Chicken habitat manipulation in the Texas coastal prairie. Pp. 257-276 in: *Proc. 12th Tall Timbers Fire Ecol. Conf.*
- Chancellor, R. ed. (1977). *1 World Conference on Birds of Prey*. Vienna, 1-3 October 1975. Report of Proceedings. ICBP, Cambridge.
- Chancellor, R. & Meyburg, B.U. eds. (1986). *Birds of Prey Bulletin No. 3*. World Working Group on Birds of Prey and Owls, Berlin, Paris & London.
- Chancellor, R. & Meyburg, B.U. eds. (1991). *Birds of Prey Bulletin No. 4*. World Working Group on Birds of Prey and Owls, Berlin, Paris & London.
- Chandler, R. & Anderson, J.M. (1974). Notes on Everglade Kite reproduction. *Amer. Birds* 28: 856-858.
- Chandler, R.E. (1970). Helminth parasites of California Quail (*Lophyrus californicus*) from the Okanagan Valley. *British Columbia. Can. J. Zool.* 48: 741-744.
- Chang, W.E. (1980). Travellers who don't need visas. The Grey-faced Buzzard-Eagle. *Environm. Sci.* 1: 58-64.
- Chapin, J.P. (1926). A new genus, *Aventornax*, proposed for *Francolinus nahani* Dubois. *Auk* 43: 235.
- Chapin, J.P. (1932). *The Birds of the Belgian Congo*. Part I. Bulletin of the American Museum of Natural History 65, New York, 756 pp.
- Chapin, J.P. (1936). A new peacock-like bird from the Belgian Congo. *Rev. Zool. Bot. Afr.* 29: 1-6.
- Chapin, J.P. (1937). The discovery of *Afrapapio congensis*. *Bull. Brit. Orn. Club* 57: 84-86.
- Chapin, J.P. (1938). The Congo Peacock. Pp. 101-109 in: *Proc. IX Int. Orn. Congr. Rouen, 1938*.
- Chapin, J.P. (1942). The Congo Peacock in captivity. *Avicult. Mag.* (5): 123-124.
- Chapin, J.P. (1946). The range of *Francolinus fischeri* extended northward. *Auk* 63: 434-435.
- Chapin, J.P. (1948). How the Congo Peacock was discovered. *Animal Kingdom* 51: 67-73.
- Chapin, J.P. (1953). Protection of birds in the Congo. Pp. 366-371 in: *Troisième Conférence Internationale pour la Protection de la Faune et de la Flore*. Birkou, Congo Belge.
- Chapin, J.P. (1954). *The Birds of the Belgian Congo*. Part 4. Bulletin of the American Museum of Natural History 75B, New York.
- Chapman, F.M. (1917). *The Distribution of Bird Life in Colombia*. Bulletin of the American Museum of Natural History 36, New York, 728 pp.
- Chapman, F.M. (1924). *The Distribution of Bird Life in the Cordillera Valley of Peru*. Smithsonian Institution. Bulletin of the American Museum of Natural History 117.
- Chapman, F.M. (1926). *The Distribution of Bird-life in Ecuador, a Contribution to a Study of the Origin of Andean Fauna*. Bulletin of the American Museum of Natural History 55.
- Chapman, F.M., Lucher, L. & Roy, O. (1981). A new subspecies of the Great Tetrax (*Tetrao urogallus*) dans le Jura gessien (Ain France). *Nos Oiseaux* 41: 81-87.
- Chasen, F.N. (1939). *The Birds of the Malay Peninsula. Volume IV: The Birds of the Low-Country, Jungle and Scrub*. Witherby, London.
- Chaudhry, A.A. (1993). Distribution and status of pheasants in Pakistan. Pp. 7-14 in: Jenkins (1993).
- Chauhan, B.S. & Sharma, V. (1991). Status of Western Tragopan. *World Pheasant Assoc. News* 34: 25-28.
- Chaut, J.F. (1985). Contribution à la connaissance de quelques comportements chez l'Aigle de Bonelli *Hieraeetus fasciatus* durant la période de reproduction dans son site de nidification (Hérault). *Le Gindrep* 3: 3-33.
- Chavez-Ramirez, F. & Enkerlin, E.C. (1991). Notes on the food habits of the Bat Falcon (*Falco rufigularis*) in Tamaulipas, Mexico. *J. Raptor Res.* 25(4): 142-143.
- Chebez, J.C. (1985). Nuestras aves amenazadas. 7: la Yacutinga (*Aburria jacutinga*). *Nuestras Aves* 3(7): 16-17.
- Chebez, J.C. (1987). Nuestras aves amenazadas. 21: el Montú (*Cras fasciolata*). *Nuestras Aves* 14: 17-18.
- Chebez, J.C. (1989). Nuevos registros de Águilas Crestadas en el nordeste argentino. *Nuestras Aves* 20(6): 6-7.
- Chebez, J.C. (1990). Los manuscritos de William Henry Partridge. 1. *Nuestras Aves* 22(8): 21-24.
- Chebez, J.C., Croome, M.S., Serret, A. & Taborda, A. (1990). La nidificación de la Harpia (*Harpia harpyja*) en Argentina. *Hornero* 13(2): 155-158.
- Cheke, A.S. (1987). The legacy of the Dodo - conservation in Mauritius. *Ornis* 21: 29-36.
- Cheng Tso-hin (1963). *China's Economic Fauna: Birds*. Science Publishing Series, Peking. (Translated by US Dept. of Commerce, Washington, D.C.).
- Cheng Tso-hin (1979a). Taxonomic and ecological notes on Capercaillie and Black Grouse in China. Pp. 83-86 in Lovel (1979).
- Cheng Tso-hin (1979b). On subspecific differentiation of the Silver Pheasant *Lophura nycthemera*. *J. World Pheasant Assoc.* 4: 42-45.
- Cheng Tso-hin (1980). A new subspecies of *Tragopan caboti* - *Tragopan caboti guineensis*. Page 13 in: *Savane* (1980).
- Cheng Tso-hin (1987). *A Synopsis of the Avifauna of China*. Science Press, Beijing & Paul Parey, Hamburg.
- Cheng Tso-hin (1990). An overview of research on pheasants in China, 1978-1988. Pp. 1-10 in Hill et al. (1990).
- Cheng Tso-hin & Wu, M.-c. (1979). A new subspecies of *Tragopan caboti* - *Tragopan caboti guineensis*. *Acta Zool. Sinica* 25: 292-294.
- Cheng Tso-hin, Chang Chun-fan et al. (1964). A new subspecies of the Silver Pheasant from Sichuan *Lophura nycthemera omeiensis*. *Acta Zootaxonomica Sinica* 1(2): 221-228.
- Cheng Tso-hin, Tan Y.-k., Lu T.-c., Tang C.-z. & Li Fu-lai (1978). *Fauna Sinica, series Vertebrata. Aves*. Vol. 4. Galliformes. Science Press, Peking.
- Chernikoff, E.M. (1965). [On the Biology of the Steller's Sea Eagle]. *Ornitologia* 7: 272-275. In Russian.
- Cherrie, G.K. (1916). A contribution to the ornithology of the Orinoco region. *Brooklyn Inst. Arts & Sci. Mus. Bull.* 2: 133-374.
- Cheyilan, G. (1972). Le cycle annuel d'un couple d'Aigles de Bonelli *Hieraeetus fasciatus* (Vieillot). *Aulauda* 41(3): 214-234.
- Cheyilan, G. (1973). Notes sur la compétition entre l'Aigle royal *Aquila chrysaetos* et l'Aigle de Bonelli *Hieraeetus fasciatus*. *Aulauda* 41(3): 203-212.
- Cheyilan, G. (1977). La place trophique de l'Aigle de Bonelli *Hieraeetus fasciatus* dans les biocoenoses méditerranéennes. *Aulauda* 45(1): 1-15.
- Cheyilan, G. (1978). Première synthèse sur le statut actuel et passé du Vautour perennopere et de l'Aigle de Bonelli en Provence. *Bull. Centre Rech. Orn. Provence* 1: 3-17.
- Cheyilan, G. (1979). Contributions au statut des rapaces provençaux: La reproduction de l'Aigle de Bonelli et du Vautour perennopere en Provence (1920 à 1979). *Bull. Centre Rech. Orn. Provence* 2: 7-14.
- Cheyilan, G. (1980). Contributions au statut des rapaces provençaux. IV. La reproduction du Vautour perennopere *Neophron percnopterus*, de l'Aigle de Bonelli *Hieraeetus fasciatus* et du Faucon Crécelletier *Falco naumanni* en 1980. *Bull. Centre Rech. Orn. Provence* 3: 4-8.
- Cheyilan, G. (1981). Sur le rôle déterminant de l'abondance des ressources dans le succès de reproduction de l'Aigle de Bonelli *Hieraeetus fasciatus* en Provence. Pp. 95-99 in: *Rapaces Méditerranéennes I*. Aix-en-Provence.
- Cheyilan, G. & Simeon, D. (1984). La reproduction de l'Aigle de Bonelli en Provence (1982-1983-1984). *Bull. Centre Rech. Orn. Provence* 6: 36-37.
- Chiba, S. (1965). [Food analysis of the Japanese Ptarmigan]. *Misc. Rep. Yamashita Inst. Orn.* 4: 184-197. In Japanese.
- Ching, H.-c., Yu S.-t. & Chiang, C.-h. (1989). A Survey of Grey-faced Buzzard-Eagle Hunting in ManChou Area Part II. KenTing National Park.
- Chittenden, H.N. (1979). The incubation, nesting and post-nesting periods of the Lizard Buzzard *Knaplous monogrammus*. *Ostrich* 50: 186-187.
- Chittenden, H.N. (1984). Aspects of Cuckoo Hawk *Aviceda cuculoides* breeding biology. Pp. 47-56 in: Mendelsohn, J.M. & Sapsford, C.W. eds. (1984). *Proceedings of the 2nd Symposium on African Predatory Birds*. Natal Bird Club, Durban.
- Chitty, D. (1967). The natural selection of self-regulatory behaviour in animal populations. *Proc. Ecol. Soc. Austr.* 2: 51-78.
- Choate, T.S. (1960). *Observations on the Reproductive Activities of the White-tailed Ptarmigan (Lagopus leucurus) in Glacier Park, Montana*. MSc thesis, Montana State University, Missoula.
- Choate, T.S. (1963a). *Ecology and Population Dynamics of White-tailed Ptarmigan (Lagopus leucurus) in Glacier National Park, Montana*. PhD thesis, Montana State University, Missoula.
- Choate, T.S. (1963b). Habitat and population dynamics of White-tailed Ptarmigan in Montana. *J. Wildl. Manage.* 27: 684-699.
- Christensen, J. (1979). Den grønlandiske Havørn *Haliaeetus albicollis groenlandicus* Brehms' ynglebiologi, rede-placering og rede [Summary: The breeding habitat, nest-site and nest of the Greenland White-tailed Eagle]. *Dan. Orn. Foren. Tidsskr.* 73: 131-156.
- Christensen, S. & Sorensen, U.G. (1989). A review of the migration and wintering of *Aquila pomarina* and *Aquila uliginosa* (Ornithol.). Pp. 139-150 in: Meyburg & Chancellor (1989).
- Christensen, Z.D. (1978). Notes on food habits of the Plain Chachalaca from the lower Rio Grande valley. *Wilson Bull.* 90: 647-648.
- Christensen, Z.D. (1970). *Nesting and Brooding Characteristics of Sharp-shinned Hawks (Accipiter velox) and White-throated Sparrows (Zonotrichia querula) in Southwestern North Dakota*. MSc thesis, University of North Dakota, Grand Forks.
- Christman, R.J.B. (1965). On the eggs of the Southern Band-tailed Harrier-eagle (*Circus fasciatus*) and the Red-necked Buzzard (*Buteo auguralis*). *Ool. Rev.* 39: 15-17.
- Christie, P. (1993). Western Plains Zoo, Dubbo, NSW, Australia. *AAPZ News* 11, January 1993. Cited in: *Int. Zoo News* 244: 61-62.
- Christy, P.A. (1993). National status and management of the Greater Prairie-Chicken. *Trans. North Amer. Wildl. Nat. Resour. Conf.* 58: 207-217.
- Christy, P.A. (1988). *The Greater Prairie-Chicken and Missouri's Land-use patterns*. Technical Series 15. Missouri Department of Conservation.
- Church, K.E. & Dancy, T.V. (1993). *Quail III. National Quail Symposium*. Missouri Department of Conservation, Jefferson City.
- Church, K.E. & Taylor, J.S. (1992). Management and research of Northern Bobwhite (*Colinus virginianus*) in North America: an overview. Pp. 787-796 in: Birkan, Potts et al. (1992).
- Church, K.E., Warner, R.E. & Brady, S.J. eds. (1990). *Pendix V: Grey Partridge and Ring-necked Pheasant Workshop*. Kansas Department Wildlife and Parks, Emporia, USA.
- Ciacio, A., Dimarce, A., Lo Valvo, F., Siracusano, M. (1987). Primi dati sulla biologia e lo status del Laniario (*Falco biarmicus*) in Sicilia. In: Baccetti & Spagnesi (1987).
- Cimera, E. & Yamamoto, T. (1990). Habitat selection and occurrence of the species of the genus *Penelope* in the Atlantic Forest. *Braz. J. Zool.* 17: 371-374.
- Clancey, P.A. (1957). A new race of *Francolinus africanus* Stephens from the Drakensberg Mountains of South Africa. *Bull. Brit. Orn. Club* 77: 58-59.
- Clancey, P.A. (1956). The avian super-species of the South African fauna. *Ostrich* 6(Suppl.): 13-39.
- Clancey, P.A. (1956). *Geographical Distribution of the South African Fauna*. Part 1: 1-46.
- Clancey, P.A. (1958a). *Falco concolor* Temminck in South Africa. *Bull. Brit. Orn. Club* 89: 10-11.
- Clancey, P.A. (1958b). Variation in *Falco dicksoni* P. L. Schaler, 1864. *Bull. Brit. Orn. Club* 89: 120-123.
- Clancey, P.A. (1971). A handlist of the birds of southern Mozambique. Laurence Marques. *Inst. Invest. Científica Moçambique (Ser. A)* 10: 145-302. 11: 1-167.
- Clancey, P.A. (1975). *Miscellaneous avian specimens from Mozambique*. 46. On the Quail *Centropus viridis* in Mozambique in the South African Sub-region. *Durban Mus. Novit.* 11: 163-176.
- Clancey, P.A. (1977). *Miscellaneous avian specimens from Mozambique*. 47. On the Quail *Centropus viridis* in Mozambique in the South African Sub-region. *Durban Mus. Novit.* 11: 248-251.
- Clancey, P.A. (1985). *The Birds of the South African Sub-region*. Part 1: 1-46.
- Clancey, P.A. (1987a). Subspeciation in the Afrotropical Goshawk *Micromystus gabar*. *Bull. Brit. Orn. Club* 107: 173-177.
- Clancey, P.A. (1987b). The authorship of the raptor name *Circus fasciatus*. *Bull. Brit. Orn. Club* 107: 191-192.

- Cox, G. (1990). The unicorn's nest. *World Pheasant Assoc. News* 29: 8-10.
- Cox, G. & Clarke, R.O. (1988a). In search of the unicorn. *World Pheasant Assoc. News* 19: 21-22.
- Cox, G. & Clarke, R.O. (1988b). Erste Ergebnisse einer Studie über den Bolivianischen Helmhukko *Pauxi unicornis* in Amboro-Nationalpark. Bolivien. *Trachilus* 9: 96-101.
- Cracraft, J. (1968). First record of the Turkey *Meleagris gallopavo* from the Pleistocene of Mexico. *Condor* 70(3): 274.
- Cracraft, J. (1973). Continental drift, paleoclimatology, and the evolution and biogeography of birds. *J. Zool., London* 169: 455-545.
- Cracraft, J. (1981). Toward a phylogenetic classification of the Recent birds of the world (class Aves). *Auk* 98: 681-714.
- Craib, C. (1977). Notes on the Lanner in the southern Transvaal. *Witwatersrand Bird Club News Sheet* 97: 5-6.
- Craib, C. (1981). Observations on Lanners. *Witwatersrand Bird Club News Sheet* 112: 3-5.
- Craib, C. (1983). Ovambo (R 157), Black (R 159) and Little (R 158) Sparrowhawks in the Transvaal. *Witwatersrand Bird Club News Sheet* 121: 19-23.
- Craig, T.H. & Trost, C.H. (1979). The biology and nesting density of breeding American Kestrel and Long-eared Owls on the Big Lost River, southwestern Idaho. *Wilson Bull.* 91: 50-61.
- Cramp, S. & Simmons, K.E.L. eds. (1980). *The Birds of the Western Palearctic*. Vol. 2. Hawks to Bustards. Oxford University Press, Oxford.
- Crandall, L.S. (1949). The Congo Peacock in captivity. *Avicult. Mag.* 55: 208.
- Crawford, J.A. (1978a). Morphology and behavior of Greater x Lesser Prairie-Chicken hybrids. *Southwestern Naturalist* 23: 591-596.
- Crawford, J.A. (1978b). Factors affecting California Quail populations on the E. E. Wilson Wildlife Area. Oregon. *Murrelet* 59: 7-13.
- Crawford, J.A. (1980). Status, problems and research needs of the Lesser Prairie Chicken. Pp. 1-7 in: Vohs & Knopf (1980).
- Crawford, J.A. & Bolen, E.G. (1975). Spring lek activity of the Lesser Prairie Chicken in west Texas. *Auk* 92: 808-810.
- Crawford, J.A. & Bolen, E.G. (1976). Effects of lek disturbances on Lesser Prairie Chickens. *Southwestern Naturalist* 21: 235-255.
- Crawford, J.A. & Lutz, R.S. (1985). Sage Grouse population trends in Oregon, 1941-1983. *Murrelet* 66: 69-74.
- Crichton, V. (1963). Autumn and winter foods of the Spruce Grouse in central Ontario. *J. Wildl. Manage.* 27: 597.
- Crick, H.Q.P. & Jones, P.J. (1992). *The Ecology and Conservation of Palearctic-African Migrants*. Blackwell Scientific Publications.
- Cringan, A.T. (1970). Reproductive biology of Ruffed Grouse in southern Ontario, 1964-1969. *J. Wildl. Manage.* 34: 756-761.
- Crispens, C.G., Buss, I.O. & Yocom, C.F. (1960). Food habits of the California Quail in eastern Washington. *Condor* 62: 473-477.
- Crocoll, S.T. & Parker, J.W. (1989). The breeding biology of the Broad-winged and Red-shouldered Hawks in western New York. *J. Raptor Res.* 23: 125-139.
- Crome, F.H.J. & Brown, H.E. (1979). Notes on social organization and breeding of the Orange-footed Scrubfowl *Megapodius reinwardt*. *Emu* 79: 111-119.
- Crowe, T.M. (1978a). *The Evolution and Ecology of Guinea fowl (Galliformes, Phasianidae, Numidinae)*. PhD thesis, University of Cape Town, South Africa.
- Crowe, T.M. (1978b). The evolution of guinea-fowl (Galliformes, Phasianidae, Numidinae): taxonomy, phylogeny, speciation and biogeography. *Ann. S. Afr. Mus.* 76(2): 43-136.
- Crowe, T.M. (1978c). Limitation of population in the Helmeted Guineafowl. *S. Afr. J. Wildl. Res.* 8: 117-126.
- Crowe, T.M. (1979). Adaptive morphological variation in Helmeted Guineafowl *Numidia meleagris* and Crested Guineafowl *Guttera pucheran*. *Ibis* 121: 313-320.
- Crowe, T.M. (1985). Guineafowl. Pp. 226-267. In: Campbell & Lack (1985).
- Crowe, T.M. & Crowe, A.A. (1985). The genus *Francolinus* as a model for avian evolution and biogeography in Africa: I. Relationships among species. Pp. 207-240 in: Schumann (1985).
- Crowe, T.M. & Kemp, A.C. (1986). African historical biogeography as reflected by galliform and hornbill evolution. Pp. 2510-2518 in: Ouellet, H. ed. (1986). *Acta XIX Int. Orn. Congr., Ottawa, 1986*. Vol. 2. University of Ottawa Press, Ottawa.
- Crowe, T.M. & Snow D.W. (1978). Numididae. Pp. 132-135. In: Snow (1978).
- Crowe, T.M., Harley, E.H., Jakutowicz, M.B., Komen, J. & Crowe, A.A. (1992). Phylogenetic, taxonomic and biogeographical implications of genetic, morphological, and behavioral variation in francolins. *Auk* 109: 24-42.
- Cruise, J. (1966). Stubble Quail, *Columia pectoralis* and their breeding behaviour. *Emu* 66: 39-45.
- Cruz, A. (1976). Food and foraging ecology of the American Kestrel in Jamaica. *Condor* 78: 409-412.
- Cruz, A. & Delannoy, C.A. (1983). *Status, Breeding Biology and Conservation Needs of the Puerto Rican Sharp-shinned Hawk Accipiter striatus venator*. Rept. work elements 4B,D, and E. US Fish Wildl. Serv. contract No. 14-16-0004-82-047.
- Culverwell, J. (1985). A shoal of Fish Eagles. *Afr. Wildl.* 39: 248.
- Cuneo, F. (1968). Notes on breeding the King Vulture *Sarcophagus papa* at Naples Zoo. *Int. Zool. Yb.* 8: 156-157.
- Cunningham, J.D. (1955). Notes of food habits of the White tailed Kite in southern California. *Condor* 57(6): 371.
- Cupper, J. (1976). Interbreeding of Brown Goshawk and White Goshawk. *Austr. Bird Watcher* 6: 306-310.
- Cupper, J. (1977). Black-breasted Buzzards rearing and preying on Kestrels simultaneously. *Austr. Bird Watcher* 7: 69-73.
- Cupper, J. & Cupper, L. (1980). Nesting of the Grey Falcon *Falco hypoleucos*. *Austr. Bird Watcher* 8: 212-219.
- Cupper, J. & Cupper, L. (1981). Hawks in Focus. Jacin, Mildura, Australia.
- Curio, E. (1992). Bericht über eine Expedition zum Erhalt des Tonga-Großfußhühns (*Megapodius pritchardii*). *World Pheasant Assoc. Rundbr.* 55: 14-17.
- Currie, L., Klapste, J. & Baker-Gabb, D.J. (1993). A preliminary study of longevity of Brown Goshawks wintering at Werribee, Victoria. In: Olsen (1993a).
- Curry-Lindhal, K. (1981). *Bird Migration in Africa*. Vol. 2. Academic Press, London.
- Czechura, G.V. (1984). The Peregrine Falcon (*Falco peregrinus macropus* Swainson) in southeastern Queensland. *J. Raptor Res.* 18: 81-91.
- Czechura, G.V. (1993). The Pacific Baza *Aviceda subseriata* in south-eastern Queensland: a review of status, natural history and conservation requirements. In: Olsen (1993a).
- Czechura, G.V. & Czechura, R.E. (1988). Interspecific conflict and an unusual display by an Australian Hobby *Falco longipennis*. *Austr. Bird Watcher* 12: 270-271.
- Czechura, G.V. & Debus, S.J.S. (1985a). The Black Falcon *Falco subniger*: a summary of information and comparison with the Brown Falcon *Falco berigora*. *Austr. Bird Watcher* 11: 80-91.
- Czechura, G.V. & Debus, S.J.S. (1985b). The Grey Falcon *Falco hypoleucos*: a summary of information. *Austr. Bird Watcher* 11: 9-16.
- Czechura, G.V. & Debus, S.J.S. (1986). The Australian Hobby *Falco longipennis*: a review. *Austr. Bird Watcher* 11: 185-207.
- Czechura, G.V., Debus, S.J.S. & Mooney, N.J. (1987). The Collared Sparrowhawk *Accipiter cirrocephalus*: a review and comparison with the Brown Goshawk *Accipiter fasciatus*. *Austr. Bird Watcher* 12: 35-62.
- Daan, S., Dijkstra, C. & Tinbergen, J.M. (1990). Family planning in the Kestrel (*Falco tinnunculus*): the ultimate control of covariation of laying date and clutch size. *Behaviour* 114(1-4): 83-116.
- Daciuk, J. (1977). Notas familiares y biológicas de Península Valdés y Patagonia. XXI. Lista sistemática y comentarios de una colección ornitológica sarcoridillera (Subregión Araucana, Prov. de Río Negro y Chubut). *Argentinean Phascos*. Vol. 19. 201-218.
- Dalke, F.D., Pyrah, D.B., Stanton, D.C., Crawford, J.E. & Schlatterer, E.F. (1960). Seasonal movements and breeding behavior of Sage Grouse in Idaho. *Trans. North Amer. Wildl. Nat. Resour. Conf.* 25: 396-407.
- Dalke, P.D., Pyrah, D.B., Stanton, D.C., Crawford, J.E. & Schlatterer, E.F. (1963). Ecology, productivity and management of Sage Grouse in Idaho. *J. Wildl. Manage.* 27: 811-841.
- Dalling, J. (1975). Lanners in central Salisbury, the first four years. *Honeyguide* 84: 23-26.
- Daneel, A.B. (1965). On the eggs of the Southern Banded Harrier-eagle (*Circus fasciatus*). *Ool. Rev.* 39: 14-15.
- Daneel, A.B. (1966a). On the range of the Southern Banded Harrier eagle. *Ool. Rev.* 40: 73-75.
- Daneel, A.B. (1966b). In search of the pygmy falcon. *Ool. Rev.* 40: 42-50.
- Danforth, C.H. (1958). *Gallus sonnerati* and the domestic fowl. *J. Heredit.* 49: 167-9.
- Daniels, B.E., Hays, L., Hays, D., Moilan, J. & Robertson, D. (1989). First record of the Common Black-hawk for California. *Western Birds* 20(1): 11-18.
- Daniels, N.N. (1965). Biogeographical considerations of the Ciconiidae. *Oenologia* 7: 440-445. In Russian.
- Danko, S. (1973). Najnovšie poznatky a hľadiska orlovo kráľovských (*Aquila heliaca*) na východnom Slovensku. *Ziva* 21: 153-155.
- Danko, S. (1986). Hrást des Schreiaadlers mit zwei fliegenden Jungen. *Orn. Mitt.* 38: 267.
- Danko, S. (1990). The present knowledge of the Lesser Spotted Eagle *Aquila pomarina* in Czechoslovakia. *Orn. Mitt.* 42: 1-10.
- Danko, S. (1991). The Lesser Spotted Eagle *Aquila pomarina* in Slovakia. *Orn. Mitt.* 43: 1-10.
- Danko, S. (1994a). Bisherige Ergebnisse der Beringung beim Kaiseradler (*Aquila heliaca*) im Nordwesten seines Brutareals. In: Meyburg & Chancellor (1994b).
- Danko, S. (1994b). The Imperial Eagle (*Aquila heliaca*) in Slovakia: History, present status, breeding success and conservation problems. In: Meyburg & Chancellor (1994b).
- Dare, P. (1961). *Ecological Observations on a Breeding Population of the Common Buzzard Buteo buteo*. PhD thesis, Exeter University.
- Derjantin, P.J. (1931). Notes on the birds of the Rio Frio (near Santa Marta, Magdalena, Colombia). *Bull. Mus. Comp. Zool.* 71: 349-421.
- Derriue, C.A. & Martinez, M.M. (1984). Estudios sobre la avifauna de Corrientes. I. Nuevos registros de aves (no Passeres). *Rev. Mus. la Plata Secc. Zool.* 13(145): 257-260.
- Dathe, H. (1971). Sparrow Hawk (*Falco sparverius*) as bat hunter in Cuba. *Mitt.* 3: 195-197.
- Dathe, H. & Grammit, W. (1993). A propos des apparitions d'Aigle des steppes (*Aquila rapax*) en Europe occidentale et centrale. *Aves* 26(3/4): 211.
- Davey, P. & Davey, G. (1980). Swallow-tailed Kites breeding at Port Lake Turkana. *East Afr. Nat. Hist. Soc. Bull.* 1980: 47-48.
- Davidson, P.J.A., Stones, A.J., Lucking, R.S., Bean, N., van Balen, B., Rahrjaniingrah, W. & Banjarsari, H. (1992). *University of East Anglia Tullaby Expedition 1991*. Preliminary mimeographed report. University of East Anglia.
- Davidson, W.R., Nettles, V.F., Couvillion, C.E. & Howerth, E.W. (1985). Diseases diagnosed in Wild Turkeys (*Meleagris gallopavo*) of the southeastern United States. *J. Wildl. Diseases* 21(4): 386-390.
- Davies, A.G. (1987). *The Gola Forest Reserves, Sierra Leone: Wildlife, Conservation and Forest Management*. IUCN, Gland, Switzerland and Cambridge, England.
- Davies, P.W. & Davis, P.E. (1973). The ecology and conservation of the Red Kite in Wales. *British Birds* 66: 183-224, 241-270.
- Davies, R. & Randall, R.M. (1989). Historical and geographical patterns in eggshell thickness of African Fish Eagles *Haliaeetus vocifer* in relation to pesticide use within southern Africa. Pp. 501-514 in: Meyburg & Chancellor (1989).
- Davis, R.G. (1973). *A Study of Demography and Behaviour of Ruffed Grouse in British Columbia*. MSc. thesis, University of Victoria.
- Davis, R.G. & Bergerud, A.T. (1988). Demography and behavior of Ruffed Grouse in British Columbia. Pp. 78-121 in: Bergerud & Graton (1988b).
- Davis, C.A., Barkley, R.C. & Haussamen, W.C. (1975). Scaled Quail foods in southeastern New Mexico. *J. Wildl. Manage.* 39: 496-502.
- Davis, C.A., Riley, T.Z., Smith, R.A. & Wisdom, M.J. (1980). Spring-summer foods of Lesser Prairie Chickens in New Mexico. Pp. 75-80 in: Vohs & Knopf (1980).
- Davis, C.A., Riley, T.Z., Smith, R.A., Suminski, H.R. & Wisdom, M.J. (1979). *Habitat Evaluation of Lesser Prairie Chickens in Eastern Chaves County, New Mexico*. New Mexico State Agricultural Experiment Station, Las Cruces.
- Davis, D. (1979). Morning and evening roosts of Turkey Vultures at Malheur Refuge, Oregon. *Western Birds* 10: 125-130.
- Davis, J.A. (1969). Aging and sexing criteria for Ohio Ruffed Grouse. *J. Wildl. Manage.* 33: 628-636.
- Davis, J.A. & Stoll, R.J. (1973). Ruffed Grouse age and sex ratios in Ohio. *J. Wildl. Manage.* 37: 133-141.
- Davis, J.R. (1976). *Management for Alabama Wild Turkeys*. Special Report 5. Alabama Department of Conservation and Natural Resources.
- Davis, L.I. (1952). Winter bird census at Xilitla, San Luis Potosi, Mexico. *Condor* 54: 345-355.
- Davis, L.I. (1972). *A Field Guide to the Birds of Mexico and Central America*. University of Texas Press, Austin & London.
- Davis, L.I. (1965). Acoustic evidence of relationships in *Ortalis*. *Southwestern Naturalist* 10: 288-301.
- Davis, P., Erard, C., Preuss, N., Tekke, M. & Tricot, J. (1966). Invasion de Caillies en Europe durant l'année 1964. *Aves* 3: 65-97.
- Davis, P.E. & Davis, J.E. (1981). The food of the Red Kite in Wales. *Bird Study* 28: 30-40.
- Davis, P.E. & Newton, I. (1981). Population and breeding of red kites in Wales over a 30-year period. *J. Anim. Ecol.* 50: 759-772.
- Davis, S.E. (1989). Migration of the Mississippi Kite (*Ictinia mississippiensis*) in Bolivia, with comments on *Ictinia plumbea*. *Bull. Brit. Orn. Club* 109: 149-152.
- Davis, T.A.W. (1975). Food of the Kestrel in winter and early spring. *Bird Study* 22: 85-91.
- Davis, T.J. (1986). Distribution and natural history of some birds from the Departments of San Martin and Amazonas, northern Peru. *Condor* 88: 50-56.
- Davis, W.B. (1944). Notes on summer birds of Guerrero. *Condor* 46: 9-14.
- Davison, G.W.H. (1974). Geographic variation in *Lophophorus sclateri*. *Bull. Brit. Orn. Club* 96: 163-164.
- Davison, G.W.H. (1976). The function of tail and under tail-cover pattern in pheasants. *Ibis* 118: 123-126.
- Davison, G.W.H. (1977). Studies of the Crested Argus. I: history and problems associated with the species in Malaysia. *J. World Pheasant Assoc.* 2: 50-56.
- Davison, G.W.H. (1978a). Studies of the Crested Argus. II: Gunong Rabong 1976. *J. World Pheasant Assoc.* 3: 46-53.
- Davison, G.W.H. (1978b). Further notes on *Lophophorus sclateri*. *Bull. Brit. Orn. Club* 98: 116-118.
- Davison, G.W.H. (1979a). *The Ecology and Behaviour of some Malaysian Galliforms with Special Reference to Argusianus argus (Phasianidae)*. PhD thesis, University Malaysia.
- Davison, G.W.H. (1979b). The behaviour of the Bandedback Pheasant *Syrniscus humiae* Hume. *J. Bombay Nat. Hist. Soc.* 76: 439-446.
- Davison, G.W.H. (1979c). Studies of the Crested Argus. III: Gunong Rabong 1977. *J. World Pheasant Assoc.* 3: 76-80.
- Davison, G.W.H. (1979d). Alleged occurrences of *Rheinartia ocellata* in Sumatra. *Bull. Brit. Orn. Club* 99: 80-81.
- Davison, G.W.H. (1980a). Problems of censusing pheasants in tropical rain forest. Pp. 49-52 in: Savage (1980).
- Davison, G.W.H. (1980b). Galliformes and the Gunung Mulu National Park. *J. World Pheasant Assoc.* 5: 31-39.
- Davison, G.W.H. (1980c). The evolution of the Crested Argus. *J. World Pheasant Assoc.* 5: 91-97.
- Davison, G.W.H. (1980d). The type locality of *Rheinartia ocellata nigrescens*. *Bull. Brit. Orn. Club* 100: 141-143.
- Davison, G.W.H. (1981a). Sexual selection and the mating system of *Argusianus argus* (Aves: Phasianidae). *Biol. J. Linn. Soc.* 15: 91-104.
- Davison, G.W.H. (1981b). Diet and dispersion of the Great Argus *Argusianus argus*. *Ibis* 123: 485-494.
- Davison, G.W.H. (1981c). Habitat requirements and the food supply of the Crested Fireback. *J. World Pheasant Assoc.* 6: 40-52.
- Davison, G.W.H. (1982a). Systematics within the genus *Arborophila* Hodgson. *Fed. Mus. J. (Malaya)* 27: 125-134.
- Davison, G.W.H. (1982b). Sexual displays of the Great Argus Pheasant. *Z. Tierpsychol.* 58: 185-202.
- Davison, G.W.H. (1983a). Behaviour of Malay Peacock Pheasant *Polyplectron malacense* (Aves: Phasianidae). *J. Zool., London* 201: 57-65.
- Davison, G.W.H. (1983b). The eyes have it: ocelli in a rain forest pheasant. *Anim. Behav.* 31: 1037-1042.
- Davison, G.W.H. (1983c). Notes on the extinct *Argusianus bipunctatus* (Wood). *Bull. Brit. Orn. Club* 103: 86-88.
- Davison, G.W.H. (1984). Moults in the Great Argus Pheasant. *J. World Pheasant Assoc.* 9: 13-18.
- Davison, G.W.H. (1985a). Spurs and ornaments among *Polyplectron* (Phasianidae). *Bull. Brit. Orn. Club* 105: 102-109.
- Davison, G.W.H. (1985b). Avian spurs. *J. Zool., London* 205: 353-365.
- Davison, G.W.H. (1985c). Peacock Pheasant display without ocelli. *Indo-Malayan Zoology* 2: 1-7.
- Davison, G.W.H. (1986a). Habitat preference and habitat change among rain forest pheasants. *J. World Pheasant Assoc.* 11: 34-39.
- Davison, G.W.H. (1986b). Some views on the adaptability of rain forest pheasants. In: Ridley (1986a).
- Davison, G.W.H. (1986c). Polymorphic rectrix number and ocellus size in *Polyplectron*. *Bull. Brit. Orn. Club* 106: 99-101.
- Davison, G.W.H. (1986d). Spurs and their function in some tropical game birds. *Bull. Brit. Orn. Club* 106: 102-109.
- Davison, G.W.H. (1987). Ecology and behaviour of Great Argus in sub-optimal habitat. Pp. 127-132 in: Savage & Ridley (1987).
- Davison, G.W.H. (1988). Francolins and their spurs. *J. World Pheasant Assoc.* 13: 21-28.
- Davison, G.W.H. (1992). Display of the Mountain Peacock Pheasant. *J. World Pheasant Assoc.* 15&16: 45-56.
- Davison, G.W.H. & Scribner, K. (1983). Recent pheasant surveys in Peninsular Malaysia. Pp. 20-31 in: Savage & Ridley (1987).
- Davygora, A.A. (1991). Analysis of disturbance factor and its effect on the Steppe Eagle in Predural'ye. Pp. 65-67. In: *Mos. XX Vsesoyuzn. ornit. konf.* Part 1. Minsk, "Navuka i tekhnika".
- Davygora, A.V. & Belik, V.P. (1994). The Pallid Harrier *Circus macrurus* as an Endangered Species in the Caucasus. In: *Malaya J. Ornithology* 11: 8-10.
- Dawson, J.W. (1980). *The Cooperative Breeding System of the Harris Hawk in Arizona*. MSc. dissertation, University of Arizona.

- Dawson, J.W. & Mannan, R.W. (1991a). Dominance hierarchies and helper contributions in Harris' Hawks. *Auk* 108(3): 649-660.
- Dawson, J.W. & Mannan, R.W. (1991b). The role of territoriality in the social organization of Harris' Hawks. *Auk* 108(3): 661-672.
- Day, D. (1984). Secretary Bird (R 105) vs Tawny Eagle (R 134). *Witwatersrand Bird Club News Sheet* 124: 14.
- Day, K.N., Flaker, I.D., & Tucker, W.L. (1991). Characteristics of Wild Turkey nest sites in a mixed-grass prairie- oak-woodland mosaic in the northern great plains, South Dakota. *Can. J. Zool.* 69: 2840-2845.
- Dean, A. (1971). Notes on *Spizopteryx circumcinctus*. *Ibis* 113: 101-102.
- Dean, W.R.J., Steyn, D., & van Reenen, A. (1968). On a second brood by a Greater Kestrel (*Falco rupicoloides* A. Smith) in the north-eastern Transvaal. *Ool. Rev.* 52: 54.
- Debus, S.J.S. (1983a). Food of the Whistling Kite at Armidale, N.S.W. *Corella* 7: 62-63.
- Debus, S.J.S. (1983b). Behaviour and vocalisations of nesting Little Eagles. *Austr. Bird Watcher* 10: 73-78.
- Debus, S.J.S. (1984a). Biology of the Little Eagle on the Northern Tablelands of New South Wales. *Emu* 84: 87-92.
- Debus, S.J.S. (1984b). Further notes on nesting Little Eagles. *Austr. Bird Watcher* 10: 196-201.
- Debus, S.J.S. (1989). Plumages and moult of the Little Eagle *Hieraaetus morphnoides*. *Austr. Bird Watcher* 13: 103-113.
- Debus, S.J.S. (1990). Daily food consumption of two captive Little Eagles. *Corella* 14: 169-171.
- Debus, S.J.S. (1991a). The Square-tailed Kite *Lophoictinia isura* in South Australia. *S. Austr. Orn.* 31: 57-71.
- Debus, S.J.S. (1991b). Further observations on the Black-breasted Buzzard *Hamirostra melanosternon* using stones to break eggs. *Austr. Bird Watcher* 14: 138-143.
- Debus, S.J.S. (1991c). An annotated list of New South Wales records of the Red Goshawk. *Austr. Birds* 24: 72-89.
- Debus, S.J.S. (1991d). Further notes on territory, breeding and plumage of the Little Eagle. *Austr. Birds* 25: 1-10.
- Debus, S.J.S. (1992). A survey of diurnal raptors in north-east New South Wales, 1987-1990. *Austr. Birds* 25: 67-77.
- Debus, S.J.S. (1993a). Further comments on the Square-tailed Kite in South Australia. *S. Austr. Orn.* 31: 145-146.
- Debus, S.J.S. (1993b). The status of the Red Goshawk *Erythrtriorchis radiatus* in New South Wales. In: Olsen (1993a).
- Debus, S.J.S. & Czechura, G.V. (1988a). Field identification of the Red Goshawk *Erythrtriorchis radiatus*. *Austr. Bird Watcher* 12: 154-159.
- Debus, S.J.S. & Czechura, G.V. (1988b). The Red Goshawk *Erythrtriorchis radiatus*: a review. *Austr. Bird Watcher* 12: 175-190.
- Debus, S.J.S. & Czechura, G.V. (1989). The Square-tailed Kite *Lophoictinia isura*: a review. *Austr. Bird Watcher* 13: 80-97.
- Debus, S.J.S. & Czechura, G.V. (1992a). The Square-tailed Kite *Lophoictinia isura* in Queensland. *Sunbird* 22: 1-18.
- Debus, S.J.S. & Czechura, G.V. (1992b). The Black-breasted Buzzard *Hamirostra melanosternon*: a review. *Austr. Bird Watcher* 14: 243-257.
- Debus, S.J.S. & Edelstam, C. (1994). Etymology and Type Locality of the Chestnut-shouldered (Bürger's) Goshawk. *Austr. Bird Watcher* 15(8).
- Debus, S.J.S. & Silveira, C.E. (1989). The Square-tailed Kite *Lophoictinia isura* in Victoria. *Austr. Bird Watcher* 13: 118-123.
- Debus, S.J.S., Earle, R.D., Millard, G.J., & Parker, C.R. (1992). Breeding behaviour of a pair of Square-tailed Kites. *Austr. Birds* 26: 1-13.
- Debus, S.J.S., Edelstam, C., & Mead, D.A. (1994). The black morph of the Chestnut-shouldered (Bürger's) Goshawk *Erythrtriorchis buergersi*. *Austr. Bird Watcher* 15(5): 212-217.
- Debus, S.J.S., Ley, A.J., Tremont, S., & Tremont, R. (1991). Breeding behaviour and diet of the Australian Hobby *Falco longipennis* in northern New South Wales. *Austr. Bird Watcher* 14: 123-137.
- Debus, S.J.S., Ley, A.J., Tremont, S.M., Tremont, R.M., & Collins, J.L. (1993). Breeding behaviour and diet of the Collared Sparrowhawk *Accipiter cirrocephalus* in northern New South Wales. *Austr. Bird Watcher* 15: 68-91.
- Debus, S.J.S., McAllan, L.A.W., & Mead, D.A. (1993a). Museum specimens of the Red Goshawk *Erythrtriorchis radiatus*. I. Annotated list of specimens. *Sunbird* 23: 5-28.
- Debus, S.J.S., McAllan, L.A.W., & Mead, D.A. (1993b). Museum specimens of the Red Goshawk *Erythrtriorchis radiatus*. II. Morphology, biology and conservation status in eastern Australia. *Sunbird* 23(3): 75-89.
- Debus, S.J.S., McAllan, L.A.W., & Morris, A.K. (1993). The Square-tailed Kite *Lophoictinia isura* in New South Wales. *Austr. Birds* 26: 104-118.
- Dee, T.J. (1986). *The Endemic Birds of Madagascar*. ICBP, Cambridge.
- Degen, A.A., Pinshov, B., & Alkon, P.L. (1983). Summer water turnover rates in free-living Chukars and Sand Partridges in the Negev Desert. *Condor* 85: 333-337.
- Degen, H.J. (1979). The Danish population of Black Grouse. Pp. 27-31 in: Lovel (1979).
- Degner, M.A. (1988). *Song, Vegetation, and Sound Production in Blue Grouse*. MSc thesis. University of Alberta, Edmonton.
- Deignan, H.G. (1945). *The Birds of Northern Thailand*. Smithsonian Institution, Washington, D.C.
- Deignan, H.G. (1948). The races of the Black-crested Baza. *Auk* 65: 284-285.
- Deignan, H.G. (1960). [On *Macheiramphus alcinus*]. *Bull. Brit. Orn. Club* 80: 121.
- Deignan, H.G. (1963). *Checklist of the Birds of Thailand*. US National Museum Bulletin 226. Smithsonian Institution, Washington, D.C.
- Dejonghe, J.F., & Mallet, B. (1978). Sur la redécouverte de la Pénélope à ailes blanches. *Penelope albigennis*. *Gerfaut* 68: 204-209.
- Dekker, D. (1971). Breeding Vulture Guineafowl *Acryptium vulturinum*. *Int. Zoo. Yb.* 11: 98.
- Dekker, D. (1988). Peregrine Falcon and Merlin predation on small shorebirds and passerines in Alberta. *Can. J. Zool.* 6: 925-928.
- Dekker, R.W.R.J. (1988a). Megapodes - from fairy tales to reality. *Bull. Oriental Bird Club* 7: 10-13.
- Dekker, R.W.R.J. (1988b). Notes on the ground temperatures at nesting sites of the Maleo *Macrocephalon maleo* (Megapodidae). *Emu* 88: 124-127.
- Dekker, R.W.R.J. (1989). Predation and the western limits of megapode distribution (Megapodidae: Aves). *J. Biogeogr.* 16: 317-321.
- Dekker, R.W.R.J. (1990a). *Conservation and Biology of Megapodes (Megapodidae, Galliformes, Aves)*. PhD thesis, University of Amsterdam.
- Dekker, R.W.R.J. (1990b). The distribution and status of nesting grounds of the Maleo *Macrocephalon maleo* in Sulawesi, Indonesia. *Biol. Conserv.* 51: 139-150.
- Dekker, R.W.R.J. ed. (1991-1993). *Megapode News*, 5(1-3), 6(1-2), 7(1).
- Dekker, R.W.R.J. (1991a). The Moluccan Megapode *Eulipota wallacii* "rediscovered". *Megapode News* 5(2-3): 9-10.
- Dekker, R.W.R.J. (1991b). *Tulegalla* or *Tulegallus*; making an end to all the confusion. *Megapode News* 5(2-3): 12.
- Dekker, R.W.R.J. (1992). Status and breeding biology of the Nicobar Megapode *Megapodius nicobariensis abbotti* on Great Nicobar, India. Report, National Museum of Natural History, Leiden.
- Dekker, R.W.R.J. (1993). Conservation and management of megapodes (Galliformes: Megapodidae). In: Diamond, A.W. & Bell, B. eds. (1993). *Management Methods for Populations of Threatened Birds*. ICBP, Cambridge, UK.
- Dekker, R.W.R.J. & Argelou, M. (1992). New Maleo nesting-grounds. *Megapode News* 6(1): 6.
- Dekker, R.W.R.J. & Brom, T.G. (1990). Maleo eggs and the amount of yolk in relation to different incubation strategies in megapodes. *Austr. J. Zool.* 38: 19-24.
- Dekker, R.W.R.J. & Jones, D.N. eds. (1992). *Proceedings of the 1st International Megapode Symposium, Christchurch, New Zealand (December 1990)*. Zoologische Verhandlungen 278. National Naturhistorisches Museum, Linde.
- Dekker, R.W.R.J. & Wattle, J. (1987). Egg and image: new and traditional uses for the Maleo (*Macrocephalon maleo*). Pp. 83-87 in: Diamond, A.W. & Filson, F.L. eds. (1987). *The Value of Birds*. ICBP, Cambridge, UK.
- Delacour, J. (1927). *Arborophila davidi* species nova. *Bull. Brit. Orn. Club* 47: 169.
- Delacour, J. (1932). Les oiseaux de la Mission Franco-Anglo-Africaine à Madagascar. *Oiseau et RFO* 2: 1-96.
- Delacour, J. (1935). Le Tallégale de Latham, ou d'Australie. *Oiseau N.S.* 5: 8-33.
- Delacour, J. (1945). Note on the eared-pheasants (*Crossoptilon*). *Zoologica* 80: 30-45.
- Delacour, J. (1948). The subspecies of *Lophura nycthemera*. *Amer. Mus. Novit.* 1377: 1-12.
- Delacour, J. (1949). The genus *Lophura*. *Ibis* 91: 188-200.
- Delacour, J. (1977). *The Pheasants of the World*. 2nd revised edition. Spur Publications, Hindhead and World Pheasant Association, Lamsash, UK.
- Delacour, J. (1978). *Pheasant Breeding and Care*. 5th edition. T.F.H. Publications.
- Delacour, J. & Amadon, D. (1973). *Curassows and Related Birds*. American Museum of Natural History, New York.
- Delacour, J. & Jabouille, P. (1925). The birds of Quàngtrí, central Annam, with notes on others from other parts of French Indo-China. *Ibis* Ser. 12: 209-260.
- Delacour, J. & Jabouille, P. (1931). *Les Oiseaux de l'Indochine Française*. 4 Vols. Impr. du Canal Siamois, Siam.
- Delacour, J. & Ridley, M.W. (1985). Pheasant. Pp. 457-460 in: Campbell & Lack (1985).
- Delacour, J., Jabouille, P., & Lowe, P.J. (1927). On the birds collected during the third expedition to French Indo-China. *Ibis* Ser. 12, no. 4: 23-51.
- Delannoy, A. (1982). Distribución, densidad, y otros aspectos de la biología del Falcón de Sierra (*Accipiter striatus venator*) en Puerto Rico. Pp. 136-150 in: *Memorias del Tercer Simposio sobre Fauna de Puerto Rico*.
- Delannoy, C.A., & Cruz, A. (1988). Breeding biology of the Puerto Rican Sharp-shinned Hawk (*Accipiter striatus venator*). *Auk* 105: 649-662.
- Delgado, G., Carrillo, J., Nogales, M., Quilis, V., & Otrujillo, O. (1990). Rapaces de las Islas Canarias. *Garxilla* 79: 10-13.
- Delgado, G., Martín, A., Quilis, V., & Emmerson, K. (1988). Alimentación del Gavilán (*Accipiter nisus*) en la isla de Tenerife. *Doñana Acta Vertebrata* 15: 193-199.
- Delibes, M. (1975). Alimentación del Milano Negro *Milvus migrans* en Doñana (Huelva, España). *Ardeola* 21: 183-207.
- Delibes, M. (1978). Ecología alimentaria del Águila Imperial Ibérica (*Aquila adalberti*) en el Coto de Doñana durante la crianza de los pollitos. *Doñana Acta Vertebrata* 5: 35-60.
- Delibes, M., Amores, F., & Calderón, J. (1975). Tamaño de puesta y mortalidad del Águila Real Ibérica (*Aquila chrysaetos hoyeri*). *Doñana Acta Vertebrata* 2: 179-191.
- Delibes, M., Calderón, J., & Hiraldo, F. (1975). Selección de presa y alimentación en España del Águila Real (*Aquila chrysaetos*). *Ardeola* 21: 285-302.
- Delibes, M., Hiraldo, F., & Calderón, J. (1984). Age and geographic variation in the Bearded Vulture *Gypaetus barbatus* (Linnaeus, 1758). *Bonn. zool. Beitr.* 35 (1-3): 71-90.
- Delius, J.D. (1953). Algo sobre el Langostero. *Homem* 10: 80.
- Delnicki, D. (1978). Second occurrence and first successful nesting record of the Hook-billed Kite in the United States. *Auk* 95(2): 427.
- Delov, V.G., & Stoyanov, G.S. (1994). Ecological Aspects of Long-term Changes in Population Density of the Kestrel *Falco tinnunculus* around Sofia. In: Meyburg & Chancellor (1994a).
- DeMaso, S.J., Guthery, F.S., Spears, G.S., & Rice, S.M. (1992). Morning cavity calls as an index of Northern Bobwhite density. *Wildl. Soc. Bull.* 20: 94-101.
- Dementiev, G.P. (1960). *Der Gefälke*. Neue Brehm Bucherei. A. Ziemsen Verlag. Wittenberg Lutherstadt.
- Dementiev, G.P. & Gladkov, N.A. eds. (1951). *The Birds of the Soviet Union*. Vol. 1 (English translation 1969). Israel Program for Scientific Translation, Jerusalem.
- Dementiev, G.P. & Gladkov, N.A. eds. (1952). *The Birds of the Soviet Union*. Vol. 4. (English translation 1967). Israel Program for Scientific Translation, Jerusalem.
- Dementiev, G.P. & Gortchakovskys, N.N. (1945). On the biology of the Norwegian Gyrfalcon. *Ibis* 87: 559-565.
- Dementiev, G.P. & Iljitsch, V.D. (1961). Bemerkungen über die morphologie der wüsten Wanderfalken. *Falke* 8: 147-154.
- Dendeleche, C. (1988). *Grands Rapaces et Corvidés des Montagnes d'Europe*. Acta Biologica Montana 8(Special Vol.).
- Deng Qi-xiang, Li Jian-guo et al. (1984). Ecology of Chinese Tragopan *Tragopan temminckii*. *Chinese Wildlife* 3: 18-24.
- Deng Wei-jei (1990). The ecological and geographical distribution of pheasants in Wolong Nature Reserve. Pp. 18-19 in: Hill et al. (1990).
- Dennis, R.H. (1983). Population studies and conservation of Ospreys in Scotland. Pp. 207-214 in: Bird (1983).
- Dennis, R.H., Ellis, P.M., Broad, R.A., & Langslow, D.R. (1984). The status of the Golden Eagle in Britain. *British Birds* 77: 592-607.
- Denton, V. (1978). Breeding experiences with Rothschild's and Bornean Peacock Pheasants. Pp. 318-21 in: Risser, A.C., Baptista, L.R., Wylne, S.R., & Gale, N.B. (1978). *Proceedings of the First International Birds in Captivity Symposium*, Seattle, Washington.
- Deraniyagala, P.E.P. (1957). Growth, subspeciation and hybridisation in the Ceylon Junglefowl. *Spolia Zeylana* 28: 99-106.
- Desai, J.H. & Malhotra, A.K. (1977). Growth and development of the Pariah Kite *Milvus migrans govinda*. *Misc. Rep. Yamashina Inst. Orn.* 9: 218-226.
- Desai, J.H. & Malhotra, A.K. (1979). Breeding biology of the Pariah Kite *Milvus migrans* at Delhi Zoological Park. *Ibis* 121: 320-325.
- Descourtilz, J.T. (1983). *História Natural das Aves do Brasil*. Editora Itatiaia Limitada, Belo Horizonte, Brazil.
- Desmet, J.F. (1988). Densité du peuplement en période de reproduction du Lagopède alpin (*Lepus timidus helveticus*, Thienemann 1829) en haute vallée du Giffre (Haute-Savoie). *Gibier Faune Sauvage* 5: 447-458.
- Dessi-Fulgheri, F., Beani, L., & Lupo, C. (1990). Hormonal correlates of social and reproductive behaviour in the Grey Partridge. Pp. 143-153 in: Balthazart, J. ed. *Hormones, Brain and Behaviour in Vertebrates 2. Behavioural Activation in Males and Females - Social Interaction and Reproductive Endocrinology*. Comp. Physiol. Karger, Basel.
- Dessi-Fulgheri, F., Beani, L., & Piazza, R. (1986). Vocalization of the Grey Partridge *Perdix Perdix* (L.): a spectrographic analysis. *Monitore zool. ital. (N.S.)* 20: 441-458.
- Deveau, B., & Catusse, M. (1987). Habitats utilisés par le Grand Tétras (*Tetrao urogallus aquitanicus*) dans la forêt pyrénéenne française en hiver et au printemps. Pp. 69-84 in: *Actes Coll. Galliformes de Montagne*. SRETIE-ONC, Grenoble.
- Dewhurst, C.F. (1986). The breeding ecology of the African Goshawk at Karen, Nairobi, Kenya. *Ostrich* 57: 1-8.
- Dewhurst, C.F. & Fishpool, L.D.C. (1984). The Swallow-tailed Kite *Chelictinia riocourii* breeding in the Kedong Valley, Kenya. *Scopus* 8: 25-26.
- Dewhurst, C.F., Cunningham-van Someren, G.R., Allan, R.G., & Thomsett, S. (1988). Observations on the breeding biology of Ayres' Eagle *Hieraetus ayresii* at Karen, Nairobi, Kenya. *Gabor* 3: 85-93.
- Dewhurst, C.F., Cunningham-van Someren, G.R., Elliott, C.C.H., Thomsett, S., & Wilson, A.C. (1989). Some observations on the nesting habits of the Cuckoo Falcon *Aviceda cuculoides* in Kenya. *Gabor* 4: 11-15.
- Dharmakumarsinghi, K.S., & Lavkumar, K.S. (1956). [On *Haliaeetus leucogaster*]. *J. Bombay Nat. Hist. Soc.* 53: 56.
- Diamond, A.W. ed. (1987). *Studies of Mascarene Islands Birds*. Cambridge University Press, Cambridge.
- Diamond, A.W. & Lovejoy, T.E. eds. (1985). *Conservation of Tropical Forest Birds*. Proceedings of ICBP Tropical Forest Birds Symposium, Cambridge, 1982. ICBP Technical Publication 3. Cambridge.
- Diamond, J.M. (1971). Bird records from west New Britain. *Condor* 73: 481-483.
- Diamond, J.M. (1972). *Avifauna of the Eastern Highlands of New Guinea*. Nuttall Ornithological Club, Cambridge, MA.
- Diamond, J.M. (1975). Distributional ecology and habits of some Bougainville birds (Solomon Islands). *Condor* 77: 14-23.
- Diamond, J.M. (1983). The reproductive biology of mound-building birds. *Nature* 301: 288-289.
- Diamond, J.M. (1985). New distributional records and taxa from the outlying mountain ranges of New Guinea. *Emu* 85: 65-91.
- Diamond, J.M., & LeCroy, M. (1979). Birds of Karkar and Bagabag Islands, New Guinea. *Bull. Amer. Mus. Nat. Hist.* 164: 467-531.
- Dias, D. (1992). Rock (*Alectoris graeca*) and Chukar (*A. chukar*) Partridge introductions in Portugal and their possible hybridisation with Red-legged Partridges (*A. rufa*): a research project. Pp. 781-784 in: Birkan, Potts et al. (1992).
- Diaz Montes, V.R. (1991). Status of the highly endangered White-winged Guan. *Cracid News* 1(1): 1, 6.
- Dickerman, R.W. (1987a). Birds of the Pacific lowlands of Guatemala. *Trans. Linn. Soc. New York* 10: 1-9.
- Dickerman, R.W. (1987b). Type localities of birds described from Guatemala. *Proc. West. Field Vert. Zool.* 3: 50-108.
- Dickey, D.R. & van Rossem, A.J.V. (1938). *The Birds of El Salvador*. Field Museum of Natural History (Zoological Series) 23. Chicago.
- Dickinson, E.C. (1986). Does the Pied Harrier *Circus melanoleucos* breed in the Philippines? *Forktail* 1: 85-86.
- Dickinson, E.C., Kennedy, R.S., & Parkes, K.C. (1991). *The Birds of the Philippines. An Annotated Checklist*. BOU Check-list 12. British Ornithologists' Union, Tring, Hertfordshire, UK.
- Dickinson, E.C., Kennedy, R.S., Read, D.K., & Rozendall, F.G. (1989). Notes on birds collected in the Philippines during the Steere Expedition of 1887/1888. *Nemoura* 32: 1-19.
- Dickman, C.R., Duly, S.E.J., & Connell, G.W. (1991). Dietary relationships of the Barn Owl and Australian Kestrel on islands off the coast of Western Australia. *Emu* 91: 69-72.
- Dickson, J.G. ed. (1992). *The Wild Turkey: Biology and Management*. Stackpole Books, Harrisburg, Pennsylvania, USA.
- Dickson, J.G., Adams, C.D., & Hanley, S.H. (1978). Response of Turkey populations to habitat variables in Louisiana. *Wildl. Soc. Bull.* 6(3): 163-166.
- Dickson, R.C. (1980). Habitat preferences and prey of Merlins in winter. *British Birds* 81: 269-274.
- Dickson, R.C. (1991). Aerial chases by Merlins in autumn and winter. *Scottish Birds* 16: 141-142.
- Didillon, M.C. (1988). Régime alimentaire de la Perdrix hochsässere (*Alectoris graeca saxatilis* = *Alectoris rufa rufa*) dans les Alpes-Maritimes. *Gibier Faune Sauvage* 5: 149-170.

- Diebold, E.N. (1993). *North American Regional Shudbook for the Cinerenus Vulture* (Aegypius monachus). Milwaukee County Zoological Park, Milwaukee, Wisconsin.
- Diesel, D.A. (1983). *Bioenergetics of the Red-tailed Hawk in Relation to Seasonal Distribution*. MSc thesis, University of Missouri, Columbia, Missouri.
- Dietzen, W. (1978). Habitat selection of nesting goshawks *Accipiter gentilis* in three regions of Bavaria. *Arch. orn. Ges. Bayern* 17: 141-160.
- Dijkstra, C. (1988). *Reproductive Tactics in the Kestrel Falco tinnunculus*. PhD Thesis, University of Groningen.
- Dimmick, R.W. (1975). Populations and reproductive effort among Bobwhites in west Tennessee. *Proc. Ann. Conf. Southeast. Assoc. Game & Fish Comm.* 28: 594-602.
- Diñelli, L. (1929). Notas biológicas sobre aves del noroeste argentino. *Hornoro* 4: 272-277.
- Dinsen, L., Lehman, T., Svendsen, J.O., Hansen, L., & Fjeldså, J. (1994). A new genus and species of peridine bird (Phasianidae, Percidini) from Tanzania: a relict form with Indo-Malayan affinities. *Ibis* 136: 3-11.
- Dinesh, S. K., & Chandola-Saklani, A. (1993). Reproductive ecology of Himalayan White Crested Kalij Pheasants in Garhwal Forests. In: Jenkins (1993).
- Ding Chang-qing & Zheng Guang-mei (1993a). A radio-tracking study of habitat selection and movements by Cabot's Tragopan in the 1991 breeding season. Pp. 76-79 in: Jenkins (1993).
- Ding Chang-qing & Zheng Guang-mei (1993b). Reproduction and development of Cabot's Tragopan exposed to long photoperiods in captivity. Pp. 119-121 in: Jenkins (1993).
- Ding Ping (1987). The Elliot's Pheasant *Symnaticus ellioti*. *Nature* (2): 40-41.
- Ding Ping & Zhu Ge Yan (1988). The ecology of *Symnaticus ellioti* Swinhoe. *Acta Ecol. Sinica* 8: 44-50.
- Ding Ping & Zhu Ge Yan (1989). White-necked Long-tailed Pheasants *Symnaticus ellioti* (Swinhoe). *Chinese J. Zool.* (2): 39-42.
- Ding Ping & Zhu Ge Yan (1990). The ecology of Elliot's Pheasant in the wild. Pp. 65-68 in: Hill et al. (1990).
- Disney, H.J. de S. (1978). The age of breeding in the Stubble Quail and Japanese Quail. *Corolla* 2: 81-4.
- Dittmann, J., Altmeier, M., Dmowski, K., Kruger, J., Muller, P., & Wagner, G. (1990). Mercury concentrations in a White-tailed Eagle (*Haliaeetus albicollis*) from the vicinity of Warsaw, Poland. *Environ. Contam.* 17(1): 75-77.
- Ditto, L.R. (1983). Observations on nesting White-tailed Hawks. *J. Raptor Res.* 17(3): 91.
- Divis, T. (1984). Number of Marsh Harrier (*Circus aeruginosus*) and its population density and dynamics in the Region of Náchod. *Zpravy Morav. Ornitolog. Sdružení* 42: 51-65.
- Dryabhanovsinh (1990). Interaction of Honey Buzzard *Pernis ptilorhynchus* with Fantail Flycatcher *Rhipidura albicollis* and Red-wattled Lapwing *Vanellus indicus*. *J. Bombay Nat. Hist. Soc.* 87 (1): 142-143.
- Dixon, J.B. (1937). The Golden Eagle in San Diego County (California). *Condor* 39: 49-56.
- Dixon, J.B., Dixon, R.E., & Dixon, J.E. (1957). Natural history of the White-tailed Kite in San Diego County, California. *Condor* 59(3): 156-165.
- Dixon, J.E.W. (1978). A preliminary investigation of some economic factors involved in the hunting of some gamebirds. *S. Afr. J. Wildl. Res.* 8: 81-82.
- Dixon, K.L. (1959). Ecological and distributional relations of desert scrub birds in western Texas. *Condor* 61: 397-409.
- von Dobay, L. (1934). [Beiträge zur Biologie der Schrei- und Schelladler]. *Köcsög* 7: 31-39. In Hungarian with German summary.
- Dobbs, J.C., & Benson, P.C. (1984). Calcium requirements and bone abnormalities in the Cape Vulture. Pp. 219-228 in: Mendelsohn, J.M., & Sapsford, C.W. eds. (1984). *Proceedings of the 2nd Symposium on African Predatory Birds*. Natal Bird Club, Durban.
- Dobler, F.C. (1989). Wintering Gyrfalcon *Falco rusticolus* habitat utilization in Washington. Pp. 61-70 in: Meyburg & Chancellor (1989).
- Dobler, F.C. (1990). Brutbiologie und territorialität bei Habicht (*Accipiter gentilis*) und Rotmilan (*Milvus milvus*). *J. Orn.* 131: 85-93.
- Dobronravov, V.P. (1949). [On the biology of the Steppe Eagle in southeastern Transbaikalia]. *Izv. Irkutsk. gos. n.-i. protivuchenn. in-ta Sibiri i Dal'nego Vostoka* 7: 183-192. In Russian.
- Dobson, A., & Ortiz, E.G. (1988). Going, going... *Quail Trends in Ecol. & Evol. (Tree)* 3(9): 217-218.
- Dodson, C.H., & Gentry, A.H. (1991). Biological extinction in western Ecuador. *Ann. Missouri Bot. Gard.* 78: 273-295.
- Doenecke, M., & Niehammer, G. (1970). Bestandsänderungen des Birkwäldes und die Wandlung der Bodennutzung im westlichen Münsterland im Verlauf der letzten 100 Jahre. *Zeit. Jagdwiss.* 16: 97-115.
- Doerr, P.D. (1973). *Ruffed Grouse Ecology in Central Alberta: Demography, Winter Feeding Activities, and the Impact of Fire*. PhD dissertation, University of Wisconsin.
- Doerr, P.D., Keith, L.B., Rusch, D.H., & Fischer, C.A. (1974). Characteristics of winter feeding aggregations of Ruffed Grouse in Alberta. *J. Wildl. Manage.* 38: 601-615.
- Dolc, J.C., & Dies, N. (1987). El Halcón de Eleonor (*Falco eleonorae*, Gené) en las islas Columbretes. Pp. 241-262 in: Matilla, A., Carretero, J.L., & García-Carrascosa, A.M. eds. (1987). *Islas Columbretes. Contribución al Conocimiento de su Medio Natural*. Conselleria d'Obres Públiques, Urbanisme i Transports, Generalitat Valenciana, Spain.
- Donaldson, J.L., & Bergerud, A.T. (1974). Behavior and habitat selection of an insular population of Blue Grouse. *Svevis* 7: 115-127.
- Donsaurov, S.S. (1947). [The Hazel Hen in Pechora-Ilych Sanctuary]. *Trudy Pechora-Ilychskogo zapovednika* 4: 77-122. In Russian.
- Donazar, J.A. (1993). *Los Buitres Ibéricos. Biología y Conservación*. J.M. Reyero Editor, Madrid.
- Donazar, J.A., & Ceballos, O. (1989). Growth rates of nestling Egyptian Vultures *Neophron percipiter* in relation to brood size, hatching order and environmental factors. *Ardea* 77: 217-226.
- Donazar, J.A., & Ceballos, O. (1990). Post-fledging dependence period and development of flight and foraging behaviour in the Egyptian Vulture *Neophron percipiter*. *Ardea* 78: 387-394.
- Donazar, J.A., Ceballos, O., Travaini, A., & Hiraldo, F. (1993). Roadside raptor surveys in the Argentinean Patagonia. *J. Raptor Res.* 27(2): 106-110.
- Donazar, J.A., Ekosegui, J., & Senosiain, A. (1987). Apparent increase in a Griffon Vulture (*Gyps fulvus*) population in Spain. *J. Raptor Res.* 21: 75-77.
- Donazar, J.A., Negro, J.J., & Hiraldo, F. (1991). A note on the adoption of alien young by Lesser Kestrel *Falco naumanni*. *Ornis* 79(3): 443-444.
- Donazar, J.A., Negro, J.J., & Hiraldo, F. (1992). Functional analysis of mat-feeding in the Lesser Kestrel *Falco naumanni*. *Ornis Scandin.* 23: 190-194.
- Donazar, J.A., Negro, J.J., & Hiraldo, F. (1993). Foraging habitat selection, land-use changes and population decline in the Lesser Kestrel *Falco naumanni*. *J. Appl. Ecol.* 30: 515-522.
- Donnelly, B.G. (1956). The range of the Booted Eagle, *Aquila pennatus* (Gmelin), in southern Africa with a note on field identification. *Ann. Cape Prov. Mus. (Nat. Hist.)* 5: 109-115.
- Donnelly, B.G., & Irwin, M.P.S. (1972). The food of *Gypohierax angolensis*. *Bull. Brit. Orn. Club* 92: 22.
- Donohoe, R.W., McKibben, C.E., & Lowry, C.B. (1968). Turkey nesting behavior. *Wilson Bull.* 80(1): 103-104.
- Dorney, R.S. (1963). Sex and age structure of Wisconsin Ruffed Grouse populations. *J. Wildl. Manage.* 27: 599-603.
- Dorst, J., & Jouanin, C. (1952). Description d'une espèce nouvelle de francolin d'Afrique Orientale. *Oiseau et R.F.O.* 22: 71-74.
- Dorst, J., & Jouanin, C. (1954). Précisions sur la position systématique et l'habitat de *Francolinus ochropectus*. *Oiseau et R.F.O.* 24: 161-170.
- Douthwaite, R.J. (1992). Effects of DDT on the Fish Eagle *Haliaeetus vocifer* population of Lake Kariha in Zimbabwe. *Ibis* 134: 250-258.
- Dovrat, E. (1980). [A summary of autumn migration along Klar Kassam route, autumn 1980]. *Torgos* 1: 32-49. In Hebrew.
- Dovrat, E. (1982). [Summary of 5 years' survey of raptor migration at Klar Kassam]. *Torgos* 2: 53-115. In Hebrew.
- Dow, D.D. (1980). Primitive weaponry in birds. The Australian Brush-turkey's defence. *Emu* 80: 91-92.
- Dow, D.D. (1988a). Dusting and sunning by Australian Brush-turkeys. *Emu* 88: 47-48.
- Dow, D.D. (1988b). Sexual interactions by Australian Brush-turkeys away from the incubation mound. *Emu* 88: 49-50.
- Dowell, S.D. (1988). Ecology and conservation of the Grey Partridge. *J. World Pheasant Assoc.* 13: 50-68.
- Dowell, S.D. (1990). A comparison of the behavior and survival of released captive-reared and wild Grey Partridges in Britain. Pp. 167-172 in: Hill et al. (1990).
- Dowsett, R.J. (1983). Breeding and other observations on the Taita Falcon *Falco forficatus*. *Ibis* 125: 362-366.
- Dowsett, R.J., & Dowsett-Lemaire, F. (1980). The systematic status of some Zambian birds. *Gerrhon* 70: 151-199.
- Dragoos, P. (1974). On the population of the Rock Partridge (*Alectoris graeca* Mersner) in Bulgaria and methods of census. *Acta Orn. Zool.* 14: 591-595.
- Drachm, G. (1993). Breeding biology of the White Hawk in Guatemala. *J. Raptor Res.* 27(1): 68.
- Drachm, G.S., & Sazacova, O.V.A. (1992). Breeding biology of the White Hawk. Pp. 153-161 in: Whittacre & Thorstein (1992).
- Drachm, G.S., Córdova, A.E.H., & Aguirre, O. (1991). Observations on the White Hawk (*Leucopternis albigollis*). Pp. 77-82 in: Whittacre et al. (1991).
- Drobelis, E. (1994). On the biology of the Lesser Spotted Eagle *Aquila pomarina* in Lithuania. In: Meyburg & Chancellor (1994b).
- Drohney, R.D., & Sparrowe, R.D. (1977). Land use relationships and movements of Greater Prairie Chickens in Missouri. *Trans. Missouri Acad. Sci.* 10-11: 146-160.
- Droge, S., & Sauer, J.R. (1990). Northern Bobwhite, Gray Partridge, and Ring-necked Pheasant population trends (1966-1988) from the North American breeding bird survey. Pages 2-20 in: Church (1990).
- Dubois, A. (1905). Remarques sur l'ornithologie de l'état indépendant du Congo, suivies d'une liste des espèces recueillies jusqu'à nos jours. *Ann. Mus. Congo Zool.* 1(4): 1-36.
- Dubs, B. (1992). *Birds of Southwestern Brazil*. Betrona-Verlag, Kusnacht, Switzerland.
- Dudley, E.P.V. (1971). Development of chicks of the Harlequin Quail. *Ostrich* 42: 79-80.
- Dudzinski, W. (1992). Grey Partridge *Perdix perdix* - predator relationships in cropland and forest habitat of central Poland. Pp. 455-466 in: Birkan, Potts et al. (1992).
- Duffy, D.C. (1992). The effectiveness of Helmeted Guineafowl in the control of the deer tick, the vector of Lyme disease. *Wilson Bull.* 104(2): 342-345.
- Dugont, J.A., Zwank, P.J., & Furman, G.C. (1986). Foods of nesting Bald Eagles in Louisiana. *J. Raptor Res.* 20: 124-127.
- Duke, G. (1989). Tragopans and nature on the grand scale: the world's largest known Western Tragopan population. *World Pheasant Assoc. News* 26: 8-10.
- Duke, G. (1991). Saving the Western Tragopan. *World Pheasant Assoc. News* 33: 27-28.
- Duke, G. (1994). Mountains, forests and pheasants. *World Birdwatch* 16(1): 10-13.
- Duncan, D.A. (1968). Food of California Quail on burned and unburned central California foothill rangeland. *Calif. Fish & Game* 54: 123-127.
- Duncan, S. (1980). An analysis of the stomach contents of some Sharp-shinned Hawks (*Accipiter striatus*). *J. Field Orn.* 51: 178.
- Dunning, S.W. (1977). Swainson's Hawk on the Laramie plains, Wyoming. *Auk* 94: 65-71.
- Dunn, P.O., & Braun, C.E. (1985). Natal dispersal and lek fidelity of Sage Grouse. *Auk* 102: 621-627.
- Dunn, P.O., & Braun, C.E. (1986). Late summer-spring movements of juvenile Sage Grouse. *Wilson Bull.* 98: 83-92.
- Dunning, J.S. (1982). *South American Land Birds*. Harrodwood Books, Newtown Square, PA.
- DuPont, J.E. (1971). *Philippine Birds*. Monograph Series 2. Delaware Museum Natural History, Greenville, Delaware.
- DuPont, J.E. (1976). *South Pacific Birds*. Delaware Museum of Natural History, Delaware.
- DuPont, J.E., & Rabor, D.S. (1973). Birds of Dinagat and Siargao, Philippines. an Expedition Report. *Nemoura* 11.
- Dupuy, A. (1969). Catalogue ornithologique du Sahara algérien. *Oiseau et R.F.O.* 39: 140-160.
- Durrer, H., & Villiger, W. (1975). Schillerstruktur des Kongopflanz (*Afpapavo congensis* Chapin 1936) im Elektronen mikroskop. *J. Orn.* 116: 94-102.
- Dutson, G. (1990). Birds of Barito Ulu in Borneo. *Bull. Oriental Bird Club* 12: 16-20.
- Dwyer, G., & Branscombe, J. (1990). *Rainforest Birds in South-West Ghana*. ICBP Study Report 46.
- Dwyer, P.D. (1981). Two species of megapode laying in the same mound. *Emu* 81: 173-174.
- Dyck, J. (1979). Winter plumage of the Rock Ptarmigan: structure of the air-filled barbs and function of the white colour. *Dan. Orn. Foren. Tidsskr.* 73: 41-58.
- Dziedziolowski, R., & Matuszewski, G. (1982). Habitat preferences of Capercaillie in lowland forests of Poland. Pp. 139-147 in: Lovel (1982).
- Eames, J.C., & Rands, M.R.W. (1993). A new perspective on the conservation of galliforms in Asia. Pp. 1-6 in: Jenkins (1993).
- Eames, J.C., Robson, C.R., Nguyen Cu & Truong Van La (1992). *Forest Bird Surveys in Vietnam*. ICBP Study Report 51.
- Earlie, R.A., Huchermeyer, F.W., Bennett, G. F., & Little, R.M. (1991). Occurrence of *Plasmodium juxta-nucleare* in Greywing Francolin. *S. Afr. J. Wildl. Res.* 21: 30-32.
- Earlie, R.A., Little, R.M., & Crowe, T.M. (1992). Haematofagia of Greywing Francolin from the Stormberg, eastern Cape Province, South Africa. *S. Afr. J. Wildl. Res.* 22: 94-97.
- Eaton, P. (1989). Harpy Eagle attempts predation on adult howler monkey. *Condor* 91(2): 469-470.
- Eaton, S.W. (1992). *Wild Turkey*. No. 22 in: Poule et al. (1992).
- Eck, S. (1986). *Entorichis astur* in Dresdner Tierkunde-Museum. *J. Orn.* 127: 93-94.
- Eddy, R. (1959). The Wedge-tailed Eagle in Bendigo, Mandurang and Big Hill Ranges. *Austr. Bird Watcher* 1: 19-22.
- Edminster, F.C. (1947). *The Ruffed Grouse: Its Life Story, Ecology and Management*. Macmillan, New York.
- Edwards, E.P. (1989). *A Field Guide to the Birds of Mexico*. E.P. Edwards, Sweet Briar, VA.
- Edwards, E.P., & Lea, R.B. (1955). Birds of the Montserrat area. *Chapman*, *Condor* 57: 31-54.
- Edwards, S.F.C. (1985). Breeding of the Western Banded Snake Eagle in Zimbabwe. *Honeyeater* 31: 213-216.
- Edwards, T.C. (1988). Temporal variation in prey preference patterns of adult Ospreys. *Auk* 105: 244-251.
- Efimenco, N.N. (1989). [The ecology of nesting species of Falconidae in the Kopet Dag State Reserve (Turkmen SSR, USSR)]. *Izvestiya Akademii Nauk Turkmen SSR Seriya Biologicheskikh Nauk* 5(5): 41-48. In Russian.
- Egler, S.G. (1991). Double-toothed Kites following lamarians. *Wilson Bull.* 103(3): 510-512.
- Ehimekensibu, Kochikensibu, Oitkensibu, & Miyazakikensibu (1989). [The migration route of Gray-faced Buzzard-eagles *Buteo swainsoni* from Shikoku to Kyushu]. *Styx* 8: 125-131. In Japanese with English summary.
- Ehrlich, P.R., Dohkins, D.S., & Wheye, D. (1992). *Birds in Jeopardy. The Imperiled and Extinct Birds of the United States & Canada*. Stanford University Press, Stanford, CA.
- Eichacker, X. (1990). First breeding record of Verreaux's Eagle *Aquila verreauxi* in Saudi Arabia. *Sandgrouse* 12: 53-54.
- Eisenmann, E. (1963). Mississippi Kite in Argentina; with comments on migration and plumages in the genus *Ictinia*. *Auk* 80: 74-77.
- Eisenmann, E. (1971). Range expansion and population increase in North and Middle America of the White-necked Kite (*Elaeetus leucurus*). *Amer. Birds* 25: 529-536.
- Eisentraut, M. (1956). Notizen über einige Vögel des Kamerungebirges. *J. Orn.* 97: 291-300.
- Eisentraut, M. (1963). Die Wirbeltiere des Kamerungebirges. Hamburg and Berlin. Paul Parey.
- Eisentraut, M. (1972). Die Wirbeltierfauna von Fernando Poo und Westkamerun. *Bonn zool. Monogr.* 3.
- Einiaer, J.C. (1988). Status of the Ornate Hawk-eagle in Mexico and Central America. *Ecos* 11(2): 8-10.
- Elbin, S.B., Crowe, T.M., & Graves, H.B. (1986). Reproductive behaviour of Helmeted Guineafowl (*Namida melanogaster*): mating system and parental care. *Appl. Animal Behav. Science* 16: 179-197.
- Ellis, J.W. (1979). *Sociability and Zoon Geography of Falcidae (Gruinae) in South America*. MSc thesis, Louisiana State University, Baton Rouge, Louisiana.
- Eley, J.W. (1982). Systematic relationships and zoogeography of the White-winged Guan (*Pendelope albipennis*) and related forms. *Wilson Bull.* 94(3): 241-259.
- Ellis, J.H. (1982). *The Birds of Nigeria: An Annotated Checklist*. BOL Checklist 4. British Ornithologists' Union, London.
- Elgood, J.H., Fry, C.H., & Dowsett, R.J. (1973). African migrants in Nigeria. *Ibis* 115: 1-45.
- Elliot, D.G. (1870-1872). *Monograph of the Phasianidae, or Family of the Pheasants*. Published by D.G. Elliot, New York, USA.
- Elliot, P.W. (1965). *Factors Affecting the Local Distribution of Blue Grouse on a Breeding Range*. MSc thesis, University of British Columbia, Vancouver.
- Ellis, D.H. (1979). *Development of Behavior in the Golden Eagle*. Wildlife Monographs 70.
- Ellis, D.H. (1982). *Ho. Primitus, Lanius, in Arizona: Habitat, Life History, and Management Recommendations*. Institute of Raptor Studies, Research Report 1. Oracle, Arizona.
- Ellis, D.H. (1992). Talon grasping by Aplomado Falcons and by Golden Eagles. *J. Raptor Res.* 26(1): 41-42.
- Ellis, D.H., & Peres, G.C. (1983). The Pallid Falcon *Falco kremerbergi* is a color phase of the Austral Peregrine Falcon (*Falco peregrinus carolin*). *Auk* 100: 269-271.
- Ellis, D.H., & Serafini, J.A. (1971). A research program for the endangered Masked Bobwhite. *J. World Pheasant Assoc.* 2: 16-33.
- Ellis, D.H., & Whaley, W.H. (1979). Two winter breeding records for the Harris' Hawk. *Auk* 96: 413.
- Ellis, D.H., & Whaley, W.H. (1981). Three Crested Eagle records for Guatemala. *Wilson Bull.* 93(2): 283-285.
- Ellis, D.H., Huchermeyer, J.C., Smith, D.G., & Fienning, S.P. (1982). Sexual maturity, growth, and reproductive success. *Bird Science* 43(1): 14-20.
- Ellis, D.H., Dobroff, S.J., & Goodwin, J.G. (1978). *Reproduction Techniques for Masked Bobwhite*. Chapter 39 in: Temple, S. ed. (1978). *Endangered Birds: Management Techniques for Preserving Threatened Species*. University of Wisconsin Press, Madison.
- Ellis, D.H., Ellis, C.H., Pendleton, G.W., Panfiliotes, A.V., & Rebrava, I.V. (1982). Distribution and conservation of Gyrfalcons in Russia. *J. Raptor Res.* 26: 81-88.
- Ellis, E.R., & Stokes, A.W. (1966). Vocalizations and behavior in captive Gambel Quail. *Condor* 68: 73-80.
- Ellis, J.A., Edwards, T.R., & Thomas, K.P. (1990). Responses of Bobwhite to simulated predator attacks. *Wilson Bull.* 102: 749-762.

- Ellis, J.E. & Lewis, J.B. (1967). Mobility and annual range of Wild Turkeys in Missouri. *J. Wildl. Manage.* **31**(3): 568-581.
- Ellis, K.L., Parrish, J.R., Murphy, J.R. & Richins, G.H. (1989). Habitat use by male breeding Sage Grouse: a management approach. *Great Basin Nat.* **49**: 404-407.
- Ellison, L.N. (1966). Seasonal foods and chemical analysis of winter diet of Alaskan Spruce Grouse. *J. Wildl. Manage.* **30**: 729-735.
- Ellison, L.N. (1968). Sexing and aging Alaskan Spruce Grouse by plumage. *J. Wildl. Manage.* **32**: 12-16.
- Ellison, L.N. (1971). Territoriality in Alaskan Spruce Grouse. *Auk* **88**: 652-664.
- Ellison, L.N. (1972). *Role of Winter Food in Regulating Numbers of Alaskan Spruce Grouse*. PhD thesis, University of California, Berkeley.
- Ellison, L.N. (1973). Seasonal social organization and movements of Alaskan Spruce Grouse. *Condor* **75**: 375-385.
- Ellison, L.N. (1974). Population characteristics of Alaskan Spruce Grouse. *J. Wildl. Manage.* **38**: 383-395.
- Ellison, L.N. (1975). Density of Alaskan Spruce Grouse before and after fire. *J. Wildl. Manage.* **39**: 468-471.
- Ellison, L.N. (1976). Winter food selection by Alaskan Spruce Grouse. *J. Wildl. Manage.* **40**: 205-213.
- Ellison, L.N. (1991). Shooting and compensatory mortality in tetraonids. *Ornis Scand.* **22**: 229-240.
- Ellison, L.N. & Magnani, Y. (1985). Éléments de dynamique de population du Tétraz-lyre (*Tetrao tetrix*) dans les Alpes françaises. *Gilbert Faune Sauvage* **2**: 63-84.
- Fillison, J.N. & Weeden, R.B. (1979). Seasonal and local weights of Alaska Spruce Grouse. *J. Wildl. Manage.* **43**: 176-183.
- Fillison, L.N., Léonard, P. & Menoni, E. (1988). Effect of shooting on a Black Grouse population in France. *Rivista Biol. Selvaggina* **141**(Suppl.): 117-128.
- Fillison, L.N., Magnani, Y. & Corti, R. (1981). Comparaison entre une population chassée et trois populations non chassées de Tétraz lyre dans les Alpes françaises. *Bull. mens. ONC* (Dec. 1981): 227-242.
- Ellsworth, D.L. & Roseberry, J.L. (1988). Biochemical genetics of wild, semi-wild, and game-farm Northern Bobwhites. *J. Wildl. Manage.* **52**: 138-144.
- Ellsworth, D.L., Roseberry, J.L. & Klimstra, W.D. (1989). Genetic structure and gene flow in the Northern Bobwhite. *Auk* **106**: 492-495.
- Elmégui, J. (1987). *Biologie et Etho-écologie du Vautour Fauve (Gyps fulvus): Mise au Point Bibliographique et Recherches dans les Pyrénées Occidentales*. Mémoire pour l'obtention du DEA. Pau University.
- Elmégui, J. (1989). *Vautour fauve (Gyps fulvus), Gypaète barbu (Gypaetus barbatus), Percennière d'Égypte (Neophron percennpterus): Synthèse Bibliographique et Recherches*. Acta Biologica Montana **3**. Centre de Biologie des Écosystèmes d'Altitude, Pau.
- Elmégui, R. (1970). Sobre la nidificación del Buitre Negro (*Aegypius monachus*) en Mallorca. *Munibe* **22**: 191-192.
- Elmégui, R. (1971). Algunos datos sobre reciente nidificación de *Aegypius monachus* en Mallorca. *Ardeola* **15**: 127-128.
- van der Elzen, R. (1975). The avifauna of Cameroon. *Bonn. Zool. Beitr.* **26**: 49-75.
- Emison, W.B. & Biley, R.J. (1982). Nesting habitat and nest site characteristics of the White-bellied Sea-Eagle in the Gippsland Lakes region of Victoria, Australia. *J. Raptor Res.* **16**: 54-58.
- Emison, W.B. & White, C.M. (1988). Foods and weights of the Rock Ptarmigan on Amchitka, Aleutian Islands, Alaska. *Great Basin Nat.* **48**: 533-540.
- Emison, W.B., Bren, W.M. & White, C.M. (1993). Influence of weather on the breeding of the Peregrine Falcon *Falco peregrinus* near Melbourne, In: Olsen (1993a).
- Emlen, J.T. (1939). Seasonal movements of a low-density Valley Quail population. *J. Wildl. Manage.* **3**: 118-130.
- Emlen, J.T. (1940). Sex and age ratios in survival of the California Quail. *J. Wildl. Manage.* **4**: 92-99.
- Emmons, S.R. (1980). *Lek Attendance of Male Sage Grouse*. MSc thesis, Colorado State University, Fort Collins.
- Emmons, S.R. & Braun, C.E. (1984). Lek attendance of male Sage Grouse. *J. Wildl. Manage.* **48**: 1023-1028.
- Emssle, S.D. (1987). Age and diet of fossil California Condors in Grand Canyon, Arizona. *Science* **237**: 768-770.
- Enderson, J.H. (1960). A population study of the Sparrow Hawk in east-central Illinois. *Wilson Bull.* **72**: 222-231.
- Enderson, J.H. (1964). A study of the Prairie Falcon in the central Rocky Mountains. *Auk* **81**: 332-352.
- Enderson, J.H. & Berger, D.D. (1970). Pesticides, eggshell thinning and lowered production of young in Prairie Falcons. *BioScience* **210**: 355-356.
- Enderson, J.H. & Wrege, P.H. (1973). DDE residues and eggshell thickness in Prairie Falcons. *J. Wildl. Manage.* **37**: 476-478.
- Enderson, J.H., Flatten, C. & Jenny, J.P. (1991). Peregrine Falcon and Merlins in Sinaloa, Mexico in winter. *J. Raptor Res.* **25**: 123-126.
- Endo, K. (1982). [The Japanese Green Pheasant]. Kaisai-sha, Ichigaya, Tokyo, Japan. In Japanese.
- Endo, K., Hirano, T. & Ueta, M. (1991). [Breeding records of the Japanese Lesser Sparrow Hawk *Accipiter gularis* in Japan]. *Siris* **10**: 171-179. In Japanese with English summary.
- Eng, R.L. (1959). *A Study on the Ecology of Male Ruffed Grouse (Bonasa umbellus L.) on the Cloquet Forest Research Center, Minnesota*. PhD thesis, University of Minnesota, Minneapolis.
- Eng, R.L. (1963). Observations on the breeding biology of male Sage Grouse. *J. Wildl. Manage.* **27**: 841-846.
- Eng, R.L. & Gullion, G.W. (1962). The predation of Goshawks upon Ruffed Grouse on the Cloquet Forest Research Center, Minnesota. *Wilson Bull.* **74**: 227-242.
- Eng, R.L. & Schladower, P. (1972). Sage Grouse winter movements and habitat use in central Montana. *J. Wildl. Manage.* **36**: 141-146.
- Eng, R.L., Toepfer, J.E. & Newell, J.A. (1988). Management of livestock to improve and maintain Prairie-Chicken habitat on the Sheyenne National Grasslands. Pp. 55-57 in: Bjegstad (1988).
- Engelring, J. & Pratt, H.D. (1985). Endangered birds in Micronesia: their history, status and future prospects. *Bird Conserv.* **2**: 71-105.
- Enquist, B.J., Cornel, I.S. & Thorstrom, R. (1992). A preliminary multivariate analysis of nesting habitat of Barred and Collared Forest-falcons (*Micrurus ruficollis* and *M. semitorquatus*). Pp. 139-144 in: Whitacre & Thorstrom (1992).
- Érard, C. & Sabatier, D. (1988). Rôle des oiseaux frugivores terrestres dans la dynamique forestière en Guyane française. Pp. 803-815 in: *Proc. XIX Int. Cong. Ottawa*, 1986, Vol. 1.
- Érard, C., Théry, M. & Sabatier, D. (1991). Régime alimentaire de *Tamias major* (Tinauidae), *Crax alcedo* (Cracidae) et *Psophodes crepitans* (Psophidae), en forêt Guyanaise. *Gilbert Faune Sauvage* **8**: 183-210.
- Eriksson, M.O.G. (1986). Fish delivery, production of young, and nest density of Osprey in southwest Sweden. *Can. J. Zool.* **64**: 1961-1965.
- Erikstad, K.E. (1978). *Relations Between Survival of Chicks, Brood Movements and Habitat Utilization in Willow Grouse*. Cand. Real. thesis, University of Bergen, Norway.
- Erikstad, K.E. (1985a). Clutch size and egg size variation in Willow Grouse *Lagopus l. lagopus*. *Ornis Scand.* **16**: 88-94.
- Erikstad, K.E. (1985b). Territorial breakdown and brood movements in Willow Grouse *Lagopus l. lagopus*. *Ornis Scand.* **16**: 95-98.
- Erikstad, K.E. (1985c). Growth and survival of Willow Grouse chicks in relation to home range size, brood movements and habitat selection. *Ornis Scand.* **16**: 181-190.
- Erikstad, K.E. (1986). Relationships between weather, body condition and incubation rhythm in Willow Grouse. *Fauna Norvegica (Ser. C. Cinclus)* **9**: 7-12.
- Erikstad, K.E. & Andersen, R. (1983). The effect of weather on survival, growth rate and feeding time in different sized Willow Grouse broods. *Ornis Scand.* **14**: 249-252.
- Erikstad, K.E. & Spilsh, T.K. (1982). The influence of weather on food intake, insect prey selection and feeding behaviour in Willow Grouse chicks in northern Norway. *Ornis Scand.* **13**: 176-182.
- Erlanger, C.F. (1905). Beiträge zur Vogelfauna Nordostafrikas. *J. Orn.* (1905): 42-158, 433-499, 670-756.
- Erlanger, C.F. (1907). Beiträge zur Vogelfauna Nordostafrikas. *J. Orn.* (1907): 1-58.
- Escalante, P. (1988). *Aves de Navarra*. Universidad Nacional Autónoma de México, Nayarit.
- Escalante, P. & Strahl, S.D. (1993). Molecular systematics and genetics of cracids. *Craida Newsl.* **2**(1): 10-11.
- Evsteyevskaya, M.A. & Bryukhanov, E.V. (1991). [Nesting of the Levant Sparrowhawk (*Accipiter brevipes*) in broad-leaved forest of the forest-steppe of the Ukraine]. *Ornitologiya* **25**: 158. In Russian.
- Espina, J. (1982). *Variaciones en la Alimentación de una Población de Milanos Negros (Milvus migrans)*. Tesina de Licenciatura, Universidad Complutense de Madrid, Spain.
- Espinoza, D.A. & Martínez, B. (1991). [Reproductive success of the Andean Condor (*Condorcorax*). *Condor* **2**: 127-137.
- Espinoza, F. (1982). Datos preliminares sobre el ciclo reproductivo y grupo de edades de la Perdiz Sabinera (*Colinus cristatus*) en el Estado Monagas. *Acta Cient. Venez.* **33**: 122.
- Espinoza, F. (1983). Ciclo reproductivo de la Perdiz Sabinera (*Colinus cristatus*) en el Estado Monagas. *Acta Cient. Venez.* **34**: 133.
- Espinoza, J.A.L., Becerra, P.J. & Espinoza, J.V. (1980). Estructura y dinámica temporal de una colonia de Buitre Negro (*Aegypius monachus*) en Sierra Morena central (Córdoba). *Bot. Estac. Cent. Ecol.* **9**: 67-71.
- Estep, J.A. & Teresa, S. (1992). Regional conservation planning for the Swainson's Hawk (*Buteo swainsoni*) in the central valley of California. Pp. 775-789 in: McCullough, D.R. & Barrett, R.H. eds. (1992). *Wildlife 2001: Fundamental*
- Estudillo López, J. (1977). Observations on the Nocturnal Curassow (*Nothocrax urumutum*) and other Cracidae. *J. World Pheasant Assoc.* **2**: 41-49.
- Estudillo López, J. (1979a). The cracidae. *Avicult. Mag.* **85**: 210-215.
- Estudillo López, J. (1979b). Horned Guan. *Amer. Pheasant & Waterfowl Soc. Mag.* **79**(6): 22-29.
- Estudillo López, J. ed. (1981). *Primer Simposio Internacional de la Familia Cracidae. Memorias*. Universidad Nacional Autónoma de México. Facultad de Medicina Veterinaria y Zootecnia. Coyoacán, Noviembre 4-7, 1981.
- Estudillo López, J. (1983). Considerations in regard to rare and endangered species of cracids both in nature and captivity. Pp. 45-61 in: *Proceedings of the Jean Delacour/FCC Symposium on breeding birds in captivity*. International Foundation for the Conservation of Birds, North Hollywood, California.
- Estudillo López, J. (1986). Notes on rare cracids in the wild and in captivity. *J. World Pheasant Assoc.* **11**: 53-66.
- Etchécopar, R.D. & Hüe, F. (1964). *Les Oiseaux du Nord de l'Afrique*. Éditions N. Boube & Cie, Paris.
- Etchécopar, R.D. & Hüe, F. (1978). *Les Oiseaux de Chine, de Mongolie et de Corée. Non Passereaux*. Les Éditions du Pacifique, Papeete, Tahiti.
- Etter, S.L. (1963). *Age Determination and Growth in Juvenile Greater Prairie-Chickens*. MSc thesis, University of Illinois, Urbana.
- Euler, C. (1968). [On *Crax blumenbachii*]. *J. Orn.* **16**: 192.
- Evans, D.L. (1982). *Status Reports on Twelve Raptors*. Special Scientific Report-Wildlife **238**. US Fish and Wildlife Service, Washington, D.C.
- Evans, D.L. & Rosenfield, R.N. (1985). Migration and mortality of Sharp-shinned Hawks ringed at Duluth, Minnesota, USA. Pp. 311-316 in: Newton & Chancellor (1985).
- Evans, I.M. & Pienkowski, M.W. (1991). World status of the Red Kite. A background to the experimental reintroduction to England and Scotland. *British Birds* **84**: 171-187.
- Evans, K.E. & Gilbert, D.L. (1969). A method for evaluating Greater Prairie-Chicken habitat in Colorado. *J. Wildl. Manage.* **33**: 643-649.
- Evans, R.M. (1961). *Courtship and Mating Behavior of Sharp-tailed Grouse (Pedioetes phasianellus jamesi Lincoln)*. MSc thesis, University of Alberta, Edmonton.
- Evans, R.M. (1969). Territorial stability in Sharp-tailed Grouse. *Wilson Bull.* **81**: 75-78.
- Evans, S.A. (1981). *Ecology and Behavior of the Mississippi Kite (Ictinia mississippiensis) in Southern Illinois*. MSc thesis, Southern Illinois University, Carbondale.
- Evans, T.D., Magsalay, P., Dutton, G.C.L. & Brooks, T.M. (1993). The conservation status of the forest birds of Siquijor, Philippines. *Forktail* **8**: 89-93.
- Eve, R. & Guigues, A.M. (1982). Birds on Ko Libong, Southern Thailand. *Nat. Hist. Bull. Siam Soc.* **30**: 91-104.
- Everett, W.T., Ward, M.L. & Brueggemann, J.J. (1989). Birds observed in the central Bering Sea pack ice in February and March 1983. *Gefuag* **79**: 159-166.
- Ey, A. (1984). Notes on Letter-winged Kites breeding in western Queensland, 1972-83. *Austr. Bird Watcher* **10**: 243-247.
- Faaborg, J. (1984). Potential for restocking Galapagos Hawks on islands where they have been extirpated. *Noticias de Galápagos* **39**: 28-30.
- Faaborg, J. (1986). Reproductive success and survivorship of the Galapagos Hawk *Buteo galapagoensis*: Potential costs and benefits of cooperative polyandry. *Ibis* **128**(3): 337-347.
- Faaborg, J., de Vries T.J., Patterson, C.B. & Griffin, C.R. (1980). Preliminary observations on the occurrence and evolution of polyandry in the Galapagos Hawk (*Buteo galapagoensis*). *Auk* **97**(3): 581-590.
- Fadeev, V.A. (1965). [Numbers and feeding of the Steppe Eagle in the area between the Volga and Ural rivers]. Pp. 390-391 in: *Mat. IV Vsesojuzn. oml. konf. Nauka, Alma Ata*. In Russian.
- Fairbairn, W.A. (1952). *Some Gamebirds of West Africa*. London.
- Falandysz, J., Jakuczun, B. & Mizera, T. (1988). Metals and organochlorines in four female White-tailed Eagles. *Marine Pollution Bull.* **19** (10): 521-526.
- Falandysz, J., Krol, W. & Jakuczun, B. (1987). [Metals and polychlorinated compounds in tissues and eggs of White-tailed Eagle *Haliaeetus albicilla* (L.) and in eggs of Lesser Spotted Eagle *Aquila pomarina* (Brehm)]. *Bromatologia i Chemia Toksykologiczna* **20** (3-4): 233-239. In Polish with Russian and English summary.
- Falanruw, M.V.C. (1975). Notes on the distribution of the Micronesian Megapode *Megapodius laperouse* in the northern Mariana Islands. *Micronesia* **11**: 149-150.
- Falla, R.A., Sibson, R.B. & Turbott, E.G. (1981). *The New Guide to the Birds of New Zealand*. Collins, Auckland & London.
- Falkenberg, I.D., Dennis, T.E. & Williams, B.D. (1994). Organochlorine pesticide contamination in three species of raptors and their prey in South Australia. *Wildlife Research* **21**: 163-173.
- Farall, U. (1994). Breeding Biology, Habitat Selection and Conservation of Montagu's Harrier *Circus pygargus* in the Northern Apennines, Italy. In: Meyburg & Chancellor (1994a).
- Farkas, T. (1965). Some interesting facts about the Crowned Guineafowl (*Numida meleagris*). *Fauna & Flora, Transvaal* **16**: 23-28.
- Farquhar, C.C. (1986). *Ecology and Breeding Behavior of the White-tailed Hawk on the Northern Coastal Prairies of Texas*. PhD dissertation, Texas A & M University, College Station.
- Farquhar, C.C. (1988). Ecology and breeding behavior of the White-tailed Hawk. Pp. 306-315 in: Glinski *et al.* (1988).
- Farquhar, C.C. (1992). White-tailed Hawk. No. **30** in: Poole *et al.* (1992).
- Farquhar, C.C. (1993). Individual and intersexual variation in alarm calls of the White-tailed Hawk. *Condor* **95**(1): 234-239.
- Farrand, J. & Olson, S.L. (1973). The correct spelling of Scopoli's specific name for the Malaysian Crested Wood Partridge (*Rolulus*). *Bull. Brit. Orn. Club* **93**: 53-54.
- Fariqi, S.A., Bump, G., Nanda, P. & Christensen, G.C. (1960). A study of the seasonal foods of the Black Francolin (*Francolinus francolinus* Linn.), the Grey Francolin (*F. pondicerianus* Gmelin) and the Common Sandpiper (*Pieroloxus exilis* Temminck) in India and Pakistan. *J. Bombay Nat. Hist. Soc.* **57**: 354-61.
- Fasce, P. & Fasce, L. (1984). *L'Aquila Reale in Italia. Ecologia e Conservazione*. Lega Italiana Protezione Uccelli. Serie Scientifica. Parma, Italia.
- Fasce, P., Fasce, L. & Torre, J. (1989). Census and observations on the biology of the Bearded Vulture *Gypaetus barbatus* on Corsica. Pp. 335-340 in: Meyburg & Chancellor (1989).
- Fasel, M. & Zbinden, N. (1983). Kausalanalyse zum Verlauf der südlichen Arealgrenze des Alpenschneehuhns *Lagopus mutus* im Tessin. *Orn. Beob.* **80**: 231-246.
- Faust, R. (1964). Geburt und Tod eines Kuttengiers. *Zool. Garten* **218**: 250-260.
- Faust, R. & Faust, I. (1963). [Breeding *Crax fasciolata*]. *Zool. Garten* **28**: 8-11.
- Favaloro, N.J. (1944). The White-breasted Sea-Eagle along the Murray Valley. *Emu* **43**: 233-242.
- Feare, C.J., Temple, S.A. & Procter, J. (1974). The status, distribution and diet of the Seychelles Kestrel *Falco area*. *Ibis* **116**: 548-551.
- Feduccia, A. (1980). *The Age of Birds*. Harvard University Press.
- Feduccia, A. & Voorheis, M. (1989). Miocene hawk converges on Secretarybird. *This* **131**: 349-354.
- Felix, F. (1964). *Orfusen*. Neue Brehm Bucherei **339**. A. Ziemsen Verlag, Wittenberg Lutherstadt.
- Feng Wen-he (1965). [Feeding habit of the Black Kite *Milvus migrans* during the breeding period in the Chengdu district (Sichuan Province)]. *Chinese J. Zool.* **7** (1): 16-17. In Chinese.
- Fenna, L. & Boag, D.A. (1974). Adaptive significance of the caeca in Japanese Quail and Spruce Grouse. *Can. J. Zool.* **52**: 1577-1584.
- Fenton, M.B., Cumming, D.H.M. & Oxley, D.J. (1978). Prey of Bat Hawks and availability of bats. *Condor* **79**: 495-497.
- Fentzloff, C. (1989). Sanford expedition 1989. *World Working Group on Birds of Prey News*. **11**: 5-9.
- Fentzloff, C. (1990). Sanford expedition (II). *World Working Group on Birds of Prey News*. **12**: 3-5.
- Fentzloff, C. & Minne Mann, D. (1994). The reintroduction of Sea Eagles *Haliaeetus albicilla* in former breeding areas in Czechoslovakia and Ireland. In: Meyburg & Chancellor (1994a).
- Ferguson-Lees, J. & Faull, E. (1992). *Endangered Birds*. George Philip, London.
- Fernández, C. (1988). *El Águila real (Aquila chrysaetos) en Navarra: Utilización del Espacio, Biología de la Reproducción y Ecología Trófica*. PhD thesis, Universidad de León, Spain.
- Fernández, C. (1991). Variation clinal du régime alimentaire et de la reproduction chez l'Aigle. *Rev. Ecol. (Terre Vie)* **46**: 363-371.
- Fernández, C., Azkona, P. & Urmeneta, A. (1991). Recensement, distribution et description des aires de chant de Grand Tétraz (*Tetrao urungallus*) dans les Pyrénées navarraises. *Acta Biologica Montana* **10**: 55-61.
- Ferrari, S.F. (1990). A foraging association between two native species (*Ictinia plumbea* and *Leptodon cayanensis*) and buffy-headed noddies (*Calidris leucophaea*) in southeastern Brazil. *Condor* **92**(3): 781-783.
- Ferrer, M. (1990). *Dispersión Juvenil de la Población de Águilas Imperiales del Parque Nacional de Doñana*. PhD thesis, Universidad de Sevilla.
- Ferrer, M. (1992). Regulation of the period of post fledging dependence in the Spanish Imperial Eagle *Aquila adalberti*. *Ibis* **134**: 128-133.
- Ferrer, M. (1993a). *El Águila Imperial*. Quercus, Madrid.
- Ferrer, M. (1993b). Juvenile dispersal behaviour and natal philopatry of a long-lived raptor, the Spanish Imperial Eagle *Aquila adalberti*. *Ibis* **135**: 132-138.

- Fyfe, R.W., Rischbrough, R.W., Monk, J.G., Jarman, W.J., Anderson, D.W. & Kiff, L. (1988). DDE, productivity, and eggshell thickness relationships in the genus *Falco*. Pp. 319-335 in: Cade et al. (1988).
- Gailey, J. & Bolwig, N. (1973). Observations on the behaviour of the Andean Condor *Vultur gryphus*. *Cmdor* 75: 27-39.
- Gajdar, A.A. (1974a). [Ringing *Tetrastes bonasia* L. and its results]. *Bulleten Moskovskogo Oshchestve Ispytatelei Prirody Otdeleniye Biologicheskoi* 78: 120-124. In Russian with English summary.
- Gajdar, A.A. (1974b). [On the breeding biology of the Hazel Hen in the area between the rivers Wjatka and Kamal]. Pp. 44-45 in: *Mit VI Vsesojuzn. ornit. konf.* Part 2. In Russian.
- Gallagher, M.D. (1977). The birds of Jubal Akhlar. In: The Scientific Results of the Oman Flora and Fauna Survey, 1975. *J. Oman Stud. Spec. Rep.* 1: 27-58.
- Gallagher, M.D. & Woodcock, M.W. (1980). *The Birds of Oman*. Quartet Books, London.
- Gallardo, J. (1986). Observations on *Elanus leucurus leucurus* Vieillot (Aves: Accipitridae). *Commun. Mus. Argent. Cienc. Nat. Bernardino Rivadavia, Inst. Nac. Invest. Cienc. Nat. Zool.* 4(15): 121-126.
- Galushin, V.M. (1962). [The Greater Spotted Eagle in the valley of the Oka river and its influence on the numbers of some birds]. *Uch. zapiski Moskov. pedagog. inst. im. Lenina* 186: 115-151. In Russian.
- Galushin, V.M. (1971). A huge urban population of birds of prey in Delhi, India. *Ibis* 113: 522.
- Galushin, V.M. (1980). [Birds of Prey of the Forest]. Moscow, Lesnaya Promyshlennost. In Russian.
- Gao Jin-hua & Zhang Bing (1984). Preliminary ecological observations on the Common Quail *Coturnix coturnix* in winter and spring. *Bull. Biol. Res.* 2(3): 48-52.
- Gao W., Xiang G., Zhang F., Song Y. & Gao Z. (1988). [On the breeding habits of Black-billed Capercaillie]. *Acta Zool. Sinica* 34: 194-195. In Chinese.
- Gao Yu-ren (1991). Present situation of the Grey Peacock Pheasant on Hainan Island. *World Pheasant Assoc. News* 33: 8-10.
- Gao Yu-ren & Liu Zhong-min (1992). [Relation between the length of spur and the age of Silver Pheasant]. *Acta Zool. Sinica* 38(3): 278-285. In Chinese.
- Gao Yu-ren & Zhang You-chang (1990). The ecology of the Silver Pheasant in Dinghushan Biosphere Reserve. Pp. 11-76 in: Hill et al. (1990).
- Garber, C.S., Mutch, B.D. & Platt, S. (1993). Observations of wintering Gyrfalcons (*Falco rusticolus*) hunting Sage Grouse (*Centrocercus urophasianus*) in Wyoming and Montana, USA. *J. Raptor Res.* 27: 169-171.
- Garcia, R., Boudarel, P. & Dendaletche, C. (1987). Premières données sur l'alimentation hivernale du Lagopède dans le massif d'Ossau (Pyrénées-Atlantiques). *Acta Biologica Montana* 7: 35-40.
- Gard, N.W. & Bird, D.M. (1990). Breeding behavior of American Kestrels raising manipulated brood sizes in years of varying prey abundance. *Wilson Bull.* 102: 605-614.
- Gardarsson, A. (1971). *Food Ecology and Spacing Behavior of Rock Ptarmigan* (*Lagopus mutus*) in Iceland. PhD thesis, University of California, Berkeley.
- Gardarsson, A. (1988). Cyclic population changes and some related events in Rock Ptarmigan in Iceland. Pp. 300-329 in: Bergerud & Graton (1988b).
- Gardarsson, A. & Moss, R. (1970). Selection of food by Icelandic Ptarmigan in relation to its availability and nutritive value. Pp. 47-71 in: Watson, A. ed. (1970). *Animal Populations in Relation to their Food Resources*. Blackwell Scientific Publications, Oxford & Edinburgh.
- Gardner, N. (1993). Finding Ceylon Spurfowl. *Bull. Oriental Bird Club* 17: 47.
- Gargett, V. (1968). Two Wahlberg's Eagle chicks - a one in forty-eight chance. *Honeyguide* 54: 26-28.
- Gargett, V. (1971). Some observations on Black Eagles *Aquila verreauxi* in the Matopos, Rhodesia. *Ostrich* 9(Suppl.): 91-124.
- Gargett, V. (1972). Black Eagle *Aquila verreauxi* population dynamics. *Ostrich* 43: 177-178.
- Gargett, V. (1975). The spacing of Black Eagles in the Matopos, Rhodesia. *Ostrich* 46: 1-44.
- Gargett, V. (1978a). Black Eagles in protected and unprotected habitats. Pp. 96-103 in: Kemp, A.C. ed. (1978). *Proceedings of a Symposium on African Predator Birds*. Northern Transvaal Ornithological Society, Pretoria.
- Gargett, V. (1978b). Sibling aggression in the Black Eagle in the Matopos, Rhodesia. *Ostrich* 49: 57-63.
- Gargett, V. (1984). The activities and behaviour of Black Eagle pairs in the Matopos, Zimbabwe. Pp. 689-706 in: Ledger (1984).
- Gargett, V. (1990). *The Black Eagle*. Acorn Books & Russel Friedman, Johannesburg.
- Gargett, V. & Gargett, E. (1993). Hard times for the Matopo Black Eagles. *Honeyguide* 39: 7-15.
- Garnett, S. (1987). An Australian record of Gurney's Eagle *Aquila gurneyi*. *Austr. Bird Watcher* 12: 134-135.
- Garnett, S. (1992). *Threatened and Extinct Birds of Australia*. RAOU Report 82. Royal Australasian Ornithologists' Union, Melbourne.
- Garrido, O.H. (1985). Cuban endangered birds. Pp. 992-999 in: Buckley et al. (1985).
- Garrido, O.H. & Montaña, F.G. (1975). *Catálogo de las Aves de Cuba*. Academia de Ciencias de Cuba, La Habana.
- Garson, P.J. (1983). The Cheer Pheasant *Catreus wallichii* in Himachal Pradesh: an update. *J. World Pheasant Assoc.* 8: 29-39.
- Garson, P.J. (1989). And the latest on Western Tragopans in India. *World Pheasant Assoc. News* 26: 11.
- Garson, P.J. (1990). Summary of discussion on captive breeding for reintroduction with special reference to the Cheer Pheasant in Pakistan. Pp. 237-239 in: Hill et al. (1990).
- Garson, P.J. & McGowan, P.J.K. (1994). *Pheasants: an Action Plan for their Conservation*. IUCN, Gland, Switzerland.
- Garson, P.J., Young, L. & Kaul, R. (1992). Ecology and conservation of the Cheer Pheasant *Catreus wallichii*: studies in the wild and the progress of a reintroduction project. *Biol. Conserv.* 59: 25-35.
- Garstone, R. (1986). Little Eagle *Hieraeetus morphnoides* takes Banded Fruit-Dove *Ptilinopus cinctus*. *Austr. Bird Watcher* 11: 242-243.
- Garsthouse, M.E. (1989). *An Avifaunal Survey of Tai National Park, Ivory Coast*. ICBP Study Report 39. Cambridge, England.
- Garzón, J., González, L.M., González, J.L. & Hiraldo, F. (1984). Situación actual y problemática del Águila Imperial ibérica (*Aquila adalberti*). Pp. 70-80 in: CRPR (1984). *Rapinyaires Mediterranis II*. Centre de Recerca i Protecció de Rapinyaires, Barcelona, Spain.
- Gasaway, W.C. (1976). Seasonal variation in diet, volatile fatty acid production and size of the cecum of Rock Ptarmigan. *Comp. Biochem. Physiol.* 53A: 109-114.
- Gasaway, W.C., Holleman, D.F. & White, R.G. (1975). Flow of digesta in the intestine and cecum of the Rock Ptarmigan. *Condor* 77: 467-474.
- Gasaway, W.C., White, R.G. & Holleman, D.F. (1976). Digestion of dry matter and absorption of water in the intestine and cecum of Rock Ptarmigan. *Condor* 78: 77-84.
- Gaston, A.J. (1980a). Field study techniques for censusing pheasants. Pp. 44-48 in: Savage (1980).
- Gaston, A.J. (1980b). Census techniques for Himalayan pheasants including notes on individual species. *J. World Pheasant Assoc.* 5: 40-53.
- Gaston, A.J. (1987a). Surveys, census, monitoring and research - their role in pheasant conservation. Pp. 33-39 in: Savage & Ridley (1987).
- Gaston, A.J. (1987b). Maps of recent pheasant observations in the Himalayas. Pp. 65-77 in: Savage & Ridley (1987).
- Gaston, A.J. & Singh, J. (1980). The status of the Cheer Pheasant *Catreus wallichii* in the Chail Wildlife Sanctuary, Himachal Pradesh. *J. World Pheasant Assoc.* 5: 68-73.
- Gaston, A.J., Garson, P.J. & Hunter, M.J. (1981a). Present distribution and status of pheasants in Himachal Pradesh, Western Himalayas. *J. World Pheasant Assoc.* 6: 10-30.
- Gaston, A.J., Garson, P.J. & Hunter, M.J. (1981b). *The Wildlife of Himachal Pradesh, Western Himalayas*. University of Maine Technical Publications 82. School of Forest Resources, Orono, Maine, USA.
- Gaston, A.J., Garson, P.J. & Hunter, M.J. (1983). The status and conservation of forest wildlife in Himachal Pradesh, Western Himalaya. *Biol. Conserv.* 27: 291-314.
- Gaston, A.J., Garson, P.J. & Pandey, S. (1993). Birds recorded in Great Himalayan National Park, Himachal Pradesh, India. *Forktail* 9: 45-57.
- Gaston, A.J., Islam K. & Crawford, J.A. (1983). The current status of the Western Tragopan *Tragopan melanocephalus*. *J. World Pheasant Assoc.* 8: 40-49.
- Gaston, A.J., Lelliott, A.D. & Ridley, M.W. (1982). Display flight of the male Monal Pheasant *Lophophorus impeyanus*. *J. World Pheasant Assoc.* 7: 90-91.
- Gate, R.J. (1985). Observations of the formation of a Sage Grouse lek. *Wilson Bull.* 97: 219-221.
- Gates, J.M. (1966). Crowing counts as indices to cock Pheasant population in Wisconsin. *J. Wildl. Manage.* 30: 735-744.
- Gates, J.M. (1972). Red-tailed Hawk populations and ecology in east central Wisconsin. *Wilson Bull.* 84: 421-433.
- Gatter, W. (1988). The Birds of Liberia. A Preliminary Checklist with Status and Open Questions. *Verh. orn. Ges. Bayern* 24: 689-723.
- Gatter, W., Peal, A., Steiner, C. & Weick, F. (1988). Die unbekannten Jugendkleider des seltenen Weißbrustperlhühns (*Acridolais melanocephala* Bonaparte, 1850). *Orn. Vogel* 10(1): 105-111.
- Gauthier, P., Daumich, W.D. & Schaefer, N. (1994). The Sooty Egret in Saudi Arabia. In: Meyburg & Chancellor (1994).
- Gaucher, P., Petit, T. & Symens, P. (1988). Notes on the study of the Sooty Falcon (*Falco concolor*) in Saudi Arabia. *Alauda* 56(3): 277-283.
- Gaugris, Y., Prigogine, A. & Van de Weghe, J.P. (1981). Additions et corrections à l'avifaune de Burundi. *Gefaut* 71: 3-39.
- Gaulden, R.L. (1993). Suburban Settlers, Harris' Hawks and people live harmoniously in the Southwest. *Birders' World* 7(6): 36-40.
- Gaumer, G.F. (1883). Notes on *Meleagris ocellata* Cuvier. *Trans. Kansas Acad. Sci.* 8: 60-62.
- Gavrin, V.F. (1969). [The ecology of Hazel Grouse in the Bielowieza fures]. *Gos. zapovednika ochom. chaz. "Belovieskaja puscha"*. Minsk 8: 130-141. In Russian.
- Gaymer, R. (1967). Observations on the birds of Aldabra in 1964 and 1965. *Atoll Res. Bull.* 118: 113-125.
- Gaymer, R., Blackman, R.A.A., Dawson, P.G., Penny, M. & Penny, C.M. (1969). The endemic birds of Seychelles. *Ibis* 111: 157-176.
- Geer, T.A. (1978). Factors affecting the delivery of prey to nestling Sparrowhawks (*Accipiter nisus*). *J. Zool., London* 195: 71-80.
- Gejlikman, B.O. (1959). [Ecology of some birds of prey in the reserve "Khosrov forest"]. *Zool. Shor. Zool. Inst. Akad. Nauk Armen SSR* 11: 5-64. In Russian.
- Geldenhuys, J.N. (1984). Status of the Fish Eagle and Goliath Heron in the Orange Free State, South Africa. Pp. 577-587 in: Ledger (1984).
- Gelling, P. (1937). Studies of the food of the East Greenland Ptarmigan, especially in its relation to vegetation and snow cover. *Medd. Grönland* 116: 1-196.
- Genelly, R.E. (1955). Annual cycle in a population of California Quail. *Condor* 57: 263-285.
- Genelly, R.E. (1978). Observations of the Australian Kestrel on Northern Tablelands of New South Wales, 1975. *Emu* 78: 137-144.
- Genero, F. (1985). Indagine sulla presenza del Grifone, *Gyps fulvus*, sulle Alpi orientali. *Riv. ital. Orn.* 55(3-4): 113-126.
- Gennaro, A.L. (1988). Breeding biology of an urban population of Mississippi Kite. Pp. 188-190 in: Glinski et al. (1988).
- Gensbøl, B. (1986). *Collins Photo Guide to the Birds of Prey of Britain and Europe, North Africa and the Middle East*. Collins, London.
- Gentz, K. (1965). Am Horst des Schreiadlers. *Falke* 12: 412-420.
- Gentz, K. (1967). [On the breeding biology of the Lesser Spotted Eagle]. *Ornithologiya* 8: 294-298. In Russian.
- Gentz, K. (1975). Die Schreidlervorkommen in den brandenburgischen Bezirken 1952 bis 1972. *Falke* 22: 52-57.
- Gerhardt, D.M., Vázquez-Marroquín, M.A. & Gerhardt, R.P. (1990). Swallow-tailed Kite (*Elanoides forficatus*). Pp. 121-127 in: Burnham et al. (1990).
- Gerhardt, R.P., Harris, P.M. & Vázquez-Marroquín, M.A. (1992). Observations and food habits of nesting Great Black Hawks in Tikal National Park, Guatemala. *J. Raptor Res.* 27(1): 70.
- Gerhardt, R.P., Harris, P.M. & Vázquez-Marroquín, M.A. (1993). Food habits of nesting Great Black Hawks in Tikal National Park, Guatemala. *Biological* 25(3): 349-352.
- Gerhardt, R.P., Vázquez-Marroquín, M.A. & Gerhardt, D.M. (1991). Breeding biology, food habits, and sibilicide of Swallow-tailed Kites (*Elanoides forficatus*). Pp. 65-71 in: Whitacre et al. (1991).
- German, M., Dragesco, J., Roux, F. & Garcin, H. (1973). Contribution à l'ornithologie du Sud-Cameroun. *Oiseau et RFO* 43: 119-182. 122-259.
- Géroudet, P. (1978). *Grand Echassiers, Gallinacés, Râles d'Europe*. Delachaux et Niestlé, Neuchâtel.
- Géroudet, P. & Grubler, W. (1967). A propos du nombre des Vautours moines à Majorque. *Nos Oiseaux* 29: 97-99.
- Gerrard, J.M. & Bortolotti, G.R. (1988). *The Bald Eagle. Haunts and Habits of a Wilderness Monarch*. Smithsonian Institution Press, Washington, D.C.
- Gerrard, J.M., Gerrard, P.N., Bortolotti, R.R. & Dzus, E.H. (1992). A 24-year study of Bald Eagles on Besnard Lake, Saskatchewan. *J. Raptor Res.* 26: 159-166.
- Gerrard, P., Gerrard, J.M., Whitfield, D.W.A. & Maher, W.J. (1974). Post-fledging movements of juvenile Bald Eagles. *Blue Jay* 32: 218-226.
- Geyr von Schweppenbrun, H. (1913). Untersuchung von Schreiadler-Gewöllen. *Z. Orn. u. Orn.* (1913): 103-105.
- Ghazanavi, D.N. (1993). Environmental education in Pakistan - the WWF experience. In: Jenkins (1993).
- Ghigi, A. (1936). *Galline di Faraone e Tacchini*. V. Hoepli, Milano.
- Ghigi, A. (1949). Sulla posizione sistemática di *Afropavo congensis* Chapin. *Mem. R. Accad. Sci. Inst. Bologna* 102, Sci. Fis. Ser. 10: 3-7.
- Giachini, P. & Pandolfi, M. (1994). Feeding Habits of Montagu's Harrier *Circus pygargus* in Central Italy. In: Meyburg & Chancellor (1994a).
- Gibbs, D. (1990). *Wallacea, A Site Guide for Birdwatchers*. D. Gibbs.
- Gibbs, R.G. & Gibbs, K. (1975). Observations at a Gray Hawk's nest. *J. Trinidad & Tobago Field Nat. Club* 2-5.
- Gibson, R.M. (1990). Relationships between blood parasites, mating success and phenotypic cues in male Sage Grouse *Centrocercus urophasianus*. *Amer. Zool.* 30: 271-278.
- Gibson, R.M. (1992). Lek formation in Sage Grouse: the effect of female choice on male territory settlement. *Anim. Behav.* 43: 443-450.
- Gibson, R.M. & Bachman, G.C. (1992). The costs of female choice in a lekking bird (*Centrocercus urophasianus*). *Behav. Ecol.* 3: 300-309.
- Gibson, R.M. & Bradbury, J.W. (1985). Sexual selection in lekking grouse: phenotypic correlates of male strutting success. *Behav. Ecol. Sociobiol.* 18: 117-123.
- Gibson, R.M. & Bradbury, J.W. (1986). Male and female mating strategies on Sage Grouse leks. Pp. 379-398 in: Rubenstein, D.L. & Wrangham, R.W. eds. (1986). *Ecological Aspects of Social Evolution*. Princeton University Press, Princeton, New Jersey.
- Gibson, R.M., Bradbury, J.W. & Vehrencamp, S.J. (1991). Mate choice in lekking Sage Grouse revisited: the roles of vocal display, female site fidelity and copying. *Behav. Ecol.* 2: 165-180.
- Gibson-Hill, C.A. (1949). An annotated checklist of the birds of Malaya. *Bull. Raffles Mus., Singapore* 20: 1-299.
- Gibson-Hill, C.A. (1952). Ornithological notes of the Raffles Museums. No. 18. The apparent breeding seasons of land birds in North Borneo and Malaya. *Bull. Raffles Mus., Singapore* 24: 270-294.
- Gierow, M. (1992). Fiskgjusen ökar, stormlommen minskar. *Anser* 31(4): 267-268.
- Giesen, K.M. (1977). *Mortality and Dispersal of Juvenile White-tailed Ptarmigan*. MSc thesis, Colorado State University, Fort Collins.
- Giesen, K.M. & Braun, C.E. (1979a). Nesting behavior of female White-tailed Ptarmigan in Colorado. *Condor* 81: 215-217.
- Giesen, K.M. & Braun, C.E. (1979b). Renesting of White-tailed Ptarmigan in Colorado. *Condor* 81: 217-218.
- Giesen, K.M. & Braun, C.E. (1979c). A technique for age determination of juvenile White-tailed Ptarmigan. *J. Wildl. Manage.* 43: 508-511.
- Giesen, K.M. & Braun, C.E. (1992). Winter home range and habitat characteristics of White-tailed Ptarmigan in Colorado. *Wilson Bull.* 104: 263-272.
- Giesen, K.M. & Braun, C.E. (1993). Natal dispersal and recruitment of juvenile White-tailed Ptarmigan in Colorado. *J. Wildl. Manage.* 57: 72-77.
- Giesen, K.M. & Connelly, J.W. (1993). Guidelines for management of Columbian Sharp-tailed Grouse habitats. *Wildl. Soc. Bull.* 21(3): 325-333.
- Giesen, K.M., Braun, C.E. & May, T.A. (1980). Reproduction and nest-site selection by White-tailed Ptarmigan in Colorado. *Wilson Bull.* 92: 188-199.
- Gill, R.B. (1965). *Distribution and Abundance of a Population of Sage Grouse in North Park, Colorado*. MSc thesis, Colorado State University, Fort Collins.
- Gill, R.E. & Kinkeloe, K.L. (1993). Are Bald Eagles important predators of Emperor Geese? *J. Raptor Res.* 27: 36-36.
- Gilliard, E.T. (1950). Notes on a collection of birds from Bataan, Luzon, Philippine Islands. *Bull. Amer. Mus. Nat. Hist.* 94: 76.
- Gilliard, E.T. & LeCroy, M. (1966). Birds of the middle Sepik region, New Guinea. Results of the American Museum of Natural History expedition to New Guinea, 1953-1954. *Bull. Amer. Mus. Nat. Hist.* 132: 247-275.
- Gilliard, E.T. & LeCroy, M. (1967a). Annotated list of birds of the Adelbert Mountains, New Guinea. *Bull. Amer. Mus. Nat. Hist.* 138: 53-81.
- Gilliard, E.T. & LeCroy, M. (1967b). Results of the 1958-1959 Gilliard-New Britain expedition. 4. An annotated list of the birds of Whiteinan Mountains, New Britain. *Bull. Amer. Mus. Nat. Hist.* 135: 173-216.
- Gilmer, D.S. & Stewart, R.E. (1984). Swainson's Hawk nesting ecology in North Dakota. *Condor* 86: 12-18.
- Gilpin, M.E. (1982). *Habitat Needs of Masked Bobwhite in Arizona*. US Fish and Wildlife Service, Albuquerque, NM.
- Gilpin, M.E. & Thompson, C.R. (1977). *Habana Use by Native Gambel's and Scaled Quail and Released Minked Bobwhite Quail in Southern Arizona*. USDA Forest Service Research Paper RM-197.
- Gines, H. & Avelado, R. (1958). *Aves de Caza de Venezuela*. Editorial Sucre (Sociedad de Ciencias Naturales La Salle Monrger 4). Caracas.
- Ginn, P.J., McIlroy, W.G. & Morrison, P. S. (1989). *The Complete Book of Southern African Birds*. Struik Publishers Ltd., Cape Town.

- Giraud-Audine, M. & Pineau, J. (1974). Nidification du Busard des roseaux (*Circus aeruginosus harterti*) en milieu nonaquatique dans la région de Tanger. *Alauda* 42: 281-288.
- Giraudoux, P., Degauquier, R., Jones, P.J., Weigel, J., & Isenmann, P. (1988). Avifaune du Niger: état des connaissances en 1986. *Malmibus* 10: 1-140.
- Gjerde, L. (1984). *A Telemet Study of Activity Patterns in Capercaillie, Tetrao urogallus during the Winter Season* MSc thesis, University of Bergen, Bergen, Norway.
- Gjerde, L. (1990). Determination of sex in Capercaillie *Tetrao urogallus* by means of winter dropping size. *Fauna Norvegica (Ser. C. Cinclus)* 13: 91-92.
- Gjerde, L. (1991a). Cues in winter habitat selection by Capercaillie. I. Habitat characteristics. *Ornis Scand.* 22: 197-204.
- Gjerde, L. (1991b). Cues in winter habitat selection by Capercaillie. II. Experimental evidence. *Ornis Scand.* 22: 205-212.
- Gjerde, L. & Wegge, P. (1989). Spacing pattern, habitat use and survival of Capercaillie in a fragmented winter habitat. *Ornis Scand.* 20: 219-225.
- Gjerde, L., Wegge, P., Pedersen, Ø., & Solberg, G. (1985). Home range and habitat use of a local Capercaillie population during winter in S.E. Norway. Pp. 247-260 in: Lovel & Hudson (1985).
- Glading, B. (1938a). A male California Quail hatches a brood. *Condor* 40: 261.
- Glading, B. (1938b). Studies on the nesting cycle of California Valley Quail in 1937. *Calif. Fish & Game* 24: 318-340.
- Glading, B. (1941). Valley Quail census methods and populations at the San Joaquin Experimental Range. *Calif. Fish & Game* 27: 33-38.
- Glading, B., Sellick, D.M., & Ross, F.T. (1945). Valley Quail under private management at the Dun Lakes Club. *Calif. Fish & Game* 31: 166-183.
- Gladkov, N.A. (1941). Taxonomy of palaearctic goshawk. *Auk* 58: 81-91.
- Glass, B.P. & Potter, G.E. (1944). Effects of photoperiodicity on egg production by female quail. *Texas Acad. Sci. Proc. & Trans.* 27: 79-81.
- Glass, P.O. (1988). Micronesian Megapode surveys and research. Pp. 131-153 in: Pittman-Robertson Federal Aid in Wildlife Restoration Program. Five Year Progress Report 1983-1987. Division of Fish & Wildlife, Commonwealth of the Northern Mariana Islands.
- Glazener, W.C. (1964). Note on the feeding habits of the Caracara in south Texas. *Condor* 66(1): 162.
- Glazener, W.C., Cook, R.S., & Trainer, D.O. (1967). A serologic study of diseases in the Rio Grande Turkey. *J. Wildl. Manage.* 31(1): 34-39.
- Glidden, J.W. (1977). Net productivity of a Wild Turkey population in southwestern New York. *Trans. Northeast. Sect. Wildl. Soc.* 34: 13-21.
- Glinski, R.L. (1982). The Red-shouldered Hawk (*Buteo lineatus*) in Arizona. *Amer. Birds* 36: 801-803.
- Glinski, R.L. & Gennaro, A.L. (1988). Mississippi Kite. Pp. 54-56 in: Glinski et al. (1988).
- Glinski, R.L. & Ohmart, R.D. (1983). Breeding ecology of the Mississippi Kite. *Condor* 85: 200-207.
- Glinski, R.L., Pendleton, B.G., Moss, M.B., LeFranc, M.N., Millsap, B.A., & Hoffman, S.W. eds. (1988). *Proceedings of the Southwest Raptor Management Symposium and Workshop*. National Wildlife Federation Science Technical Series 11. Washington, D.C.
- Glotov, I.N. (1959). [Materials on the biology of the Greater Spotted Eagle (*Aquila clanga* Pall.)]. *Trudy Biol. Inst. Sib. Otd. Akad. Nauk SSSR (Novosibirsk)* 5: 167-170. In Russian.
- Glover, F.A. (1947). Flight speed of Wild Turkeys. *Auk* 64: 623-624.
- Glover, F.A. (1949). Winter foods of Wild Turkeys in West Virginia. *J. Wildl. Manage.* 12: 416-427.
- Glover, R.G. (1977). Early menageries, the animal trade & curassows. *J. World Pheasant Assoc.* 2: 57-61.
- Glutz von Blotzheim, U.N. (1981). Le Tétrin lyre (*Lyrurus tetrax*) Linné 1758. *Bull. mens. O.N.C.* (Dec. 1981): 3-86.
- Glutz von Blotzheim, U.N., Bauer, K.M., & Bezel, E. eds. (1971). *Handbuch der Vögel Mitteleuropas*. Vol. 4. Falconiformes. Akademische Verlagsgesellschaft, Frankfurt & Main.
- Glutz von Blotzheim, U.N., Bauer, K.M., & Bezel, E. eds. (1973). *Handbuch der Vögel Mitteleuropas*. Vol. 5. Akademische Verlagsgesellschaft, Frankfurt am Main.
- Glutz von Blotzheim, U.N. et al. (1985). *Les Tétrinides*. Station Ornithologique Suisse, Sempach, Switzerland.
- Gochfeld, M. & Keith, S. (1977). The Red-billed Curassow. *Oryx* 14: 22-23.
- Gochfeld, M., Kleinbaum, M., & Tudor, G. (1978). Observations on behavior and vocalizations of a pair of wild Harpy Eagles. *Auk* 95(1): 192-194.
- Godfrey, G.A. (1967). *Summer and Fall Movements and Behavior of Immature Ruffed Grouse* (Bonasa umbellus L.). MSc thesis, University of Minnesota, St. Paul.
- Godfrey, G.A. (1975). Home range characteristics of Ruffed Grouse broods in Minnesota. *J. Wildl. Manage.* 39: 287-298.
- Godfrey, G.A. & Marshall, W.H. (1969). Brood break-up and dispersal of Ruffed Grouse. *J. Wildl. Manage.* 33: 609-620.
- Godfrey, W.E. (1966). *The Birds of Canada*. Queen's Printer, Ottawa.
- Goethe, F. (1989). [Immature White-tailed Eagle (*Haliaeetus albicilla*) feeds on Herring Gull chicks for 3 weeks on Memmert (West Germany)]. *Drosophila* 89(1-2): 63-66. In German with English summary.
- Goldstein, D.L. (1983). The effect of wind on avian metabolic rate with particular reference to Gambel's Quail. *Physiol. Zool.* 56: 485-492.
- Goldstein, D.L. (1984). The thermal environment and its constraint on activity of desert quail in summer. *Auk* 101: 542-550.
- Golodushko, B.Z. (1958). [On food of the Common Buzzard (*Buteo buteo* L.) and the Lesser Spotted Eagle (*Aquila pomarina* Brehm) in the Bialowieza Forest reserve]. *Trudy Zapevodo-ochotnogo chuzojstva Belorusskaja Polesie* 1: 100-109. In Russian.
- Golodushko, B.Z. (1959). [Data on the ecology of the Lesser Spotted Eagle in the Bialowieza Forest]. Pp. 34-35 in: *Tezisy dokladov 1-aj zool. Konf. Belorusskoj SSR*. Minsk. In Russian.
- Golodushko, B.Z. (1961). [Numbers of amphibians and reptilians and their role in nutrition of the Common Buzzard and the Lesser Spotted Eagle in the Bialowieza Forest reserve]. Pp. 143-149 in: *Fauna i ekologiya naczemnykh pozvonochnykh Belorussii*. In Russian.
- Gonzaga, L.P., Scott, D.A., & Collar, N.J. (1987). *The Status and Birds of some Forest Fragments in Eastern Brazil: Report on a Survey Supported by Companhia Vale do Rio Doce, October 1986*. Unpublished report.
- Gonzales, R.B. (1968). A study of the breeding biology and ecology of the Monkey-eating Eagle. *Silliman J.* 15: 338-342.
- González, G. & Novoa, C. (1989). Partage de l'espace entre le Lagopède *Lagopus mutus pyrenaicus* et la Perdrix grise *Perdix perdix hispanica* dans le massif du Carlit (Pyrénées Orientales) en fonction de l'altitude et de l'exposition. *Rev. Ecol. (Terre Vie)* 44: 347-360.
- González, G., Santiago, J.M., & Fernández, L. (1992). *El Águila Pescadora Pandion haliaetus en España*. ICONA, Madrid.
- González, J.L. (1991). *El Águila Lagunero Circus aeruginosus (L., 1748) en España. Situación, Biología de la Reproducción, Alimentación y Conservación*. ICONA & CSIC, Madrid.
- González, J.L. & Merino, M. (1991). *El Cernicalla Primitiva (Falco naumanni) en la Península Ibérica. Situación, Problemática y Aspectos Biológicos*. ICONA, Madrid.
- González, L.M. (1990). Aves en la Lista Roja: El Águila Imperial. *La Gaceta* 79: 14-17.
- González, L.M. (1991a). *Historia Natural de Aves, Imperial (tercera Águila adalberto Brehm, 1861)*. *Patrimonio. Análisis de la Distribución Geográfica, Alimentación, Reproducción y Conservación*. ICONA, Colección Técnica, Madrid.
- González, L.M. (1991b). Censo de las poblaciones reproductoras de Águila Imperial y Buitre Negro en España. *Quercus* 58: 16-22.
- González, L.M. & Grande, J.L. (1991). *El Mundo del Águila Imperial Ibérica*. Madrid.
- González, L.M. & Hiraldo, F. (1987). Oviposition time and heavy metals contamination in the eggs of the Spanish Imperial Eagle (*Aquila adalberti*) and accompanying changes in eggshell morphology and chemistry. *Environm. Pollut.* 51: 241-258.
- González, L.M., Alonso, J.C., González, J.L., & Heredia, B. (1985). Estudios sobre la reproducción del Águila Imperial Ibérica (*Aquila adalberti*). Monografía ICONA 36.
- González, L.M., Bustamante, J., & Hiraldo, F. (1990). Factors influencing the present distribution of the Spanish Imperial Eagle (*Aquila adalberti*). *Biol. Conserv.* 51: 311-319.
- González, L.M., González, J.L., Garrón, J., & Heredia, B. (1987). Censo y distribución del Águila Imperial Ibérica (*Aquila adalberti*) en España durante el periodo 1981-1986. *Bol. Estac. Cent. Ecol.* 31: 99-109.
- González, L.M., Heredia, B., González, J.L., & Alonso, J.C. (1989). Juvenile dispersal of the Spanish Imperial Eagle (*Aquila adalberti*). *J. Field Orn.* 60: 303-320.
- González, L.M., Hiraldo, F., Delibes, M., & Calderón, J. (1989a). Reduction in the range of the Spanish Imperial Eagle (*Aquila adalberti*) since AD 1850. *J. Biogeogr.* 16: 305-315.
- González, L.M., Hiraldo, F., Delibes, M., & Calderón, J. (1989b). Geographic support to consider the Spanish Imperial Eagle as a distinct species. *Biol. Res. Cent. (Cien.)* 109: 89-93.
- González, M.J. (1980). *Plaza de Montaña, Área de Reserva Natural, Municipio de San Mateo, General Fernández Cruz*. San José, Escuintla, Guatemala. PhD thesis, Universidad del Valle, Guatemala.
- González, P.C. (1983). Birds of the Catanduanes. *Zool. Pap. Nat. Mus. Manila* 2.
- González-García, F. (1984). *Aspectos Biológicos del Pavón Oreophaps derhami G. R. Gray (Aves, Ciconiidae) en la Reserva Natural "El Triunfo", Municipio de Angel Albino Corzo o Jaltenango la Paz, Chiapas*. Tesis de licenciatura. Facultad de Ciencias Biológicas, Universidad Veracruzana, Xalapa, Veracruz, México.
- González-García, F. (1988a). Ecología y distribución del Pavón *Oreophaps derhami* en México: pasado, presente y futuro. Unpublished report presented at the II International Ciconid Symposium, Caracas, Venezuela. February/March 1988.
- González-García, F. (1988b). Crecimiento y desarrollo de *Oreophaps derhami* bajo condiciones de cautividad. Unpublished report presented at the II International Ciconid Symposium, Caracas, Venezuela. February/March 1988.
- González-García, F. (1988c). The Horned Guan. *Animal Kingdom* 91(4): 21-22.
- González-García, F. (1991). Observaciones sobre la ecología y biología reproductiva del Pavón *Oreophaps derhami* en la Reserva de la Biosfera "El Triunfo", Chiapas, México. Unpublished report presented at the IV Congreso de Ornitología Neotropical, Quito, Ecuador, November 1991.
- González-García, F. (1993a). Illegal trade of Horned Guans. *Craud Newsl.* 2(1): 1-7.
- González-García, F. (1993b). News on the study and conservation of the Horned Guan in Mexico. *Craud Newsl.* 2(1): 13.
- González-García, F. (1994). Behavior of Horned Guans (*Oreophaps derhami*) Ciconiidae in Chiapas, Mexico. *Wilson Bull.* 106.
- González-García, F. & Bubh, P.J. (1989). Estudio y conservación del Pavón (*Oreophaps derhami*) en la Sierra Madre de Chiapas, Xalapa, México: Informe de actividades. Unpublished report to Instituto de Ecología, A.C. & Wildlife Conservation International.
- Good, A.J. (1952). The birds of French Cameroon. *Mém. Inst. fr. Afr. noire (Ser. Sci. nat.)* 2.
- Goodall, J.D., Johnson, A.W., & Phillips, R.A. (1957). *Las Aves de Chile*. Vol. 2. Plati Establecimientos Gráficos, Buenos Aires.
- Goodman, S.M. & González, P.C. (1990). The birds of Mt Isarog National Park, southern Luzon, Philippines with particular reference to altitudinal distribution. *Feldiana* 60: 1-39.
- Goodman, S.M. & Haynes, C.V. (1989). The distribution, breeding season, and food habits of the Lanner from the eastern Sahara. *Natl. Geog. Res.* 5: 126-131.
- Goodman, S.M. & Haynes, C.V. (1992). The diet of the Lanner (*Falco biarmicus*) in a hyper-arid region of the eastern Sahara. *J. Arid Environ.* 22: 93-98.
- Goodman, S.M. & Pidgeon, M. (1991). Madagascar Harrier Hawk *Polyboroides radiatus* preying on flying fox *Pteropus rufus*. *Ostrich* 62: 215-216.
- Goodman, S.M., Meininger, P.L., Baha El Din, S.M., Hobbs, J.J., & Mullié, W.C. (1989). *The Birds of Egypt*. Oxford University Press, Oxford & New York.
- Graham, D. (1953). Observations on voice and behaviour of the Red-legged Partridge *Alectoris rufa*. *Ibis* 95: 581-614.
- Goodwin, D. (1954). Notes on captive Red-legged Partridges. *Avicult. Mag.* 60: 49-61.
- Goodwin, D. (1958). Further notes on pairing and submissive behaviour of the Red-legged Partridge *Alectoris rufa*. *Ibis* 100: 59-66.
- Goodwin, D. (1975). Birds of the Harold Hall Australian expeditions 1962-70. Galliformes—fowl-like birds. *Publ. Brit. Mus. Nat. Hist.* 745: 60-62.
- Goodwin, D. (1982). On the status of the Green Pheasant. *Bull. Brit. Orn. Club* 102: 35-37.
- Gorbun, I. (1994). Lesser and Greater Spotted Eagle *Aquila pomarina* and *Aquila clanga* in Ukraine. In: Meyburg & Chancellor (1994b).
- Gordon, S.T. (1955). *The Golden Eagle: King of Birds*. Melvin Press, Perth, UK.
- Gore, M.E.J. (1990). *Birds of Gambia*. BOU Checklist 3. 2nd. revised edition. British Ornithologists' Union, London.
- Gore, M.E.J. & Gepp, A.R.M. (1978). *Las Aves del Uruguay*. Mosca Hnos., Montevideo.
- Gore, M.E.J. & Won, P.O. (1971). *The Birds of Korea*. Royal Asiatic Society, Seoul.
- Gorschuch, D.M. (1934). Life history of the Gambel quail in Arizona. *Univ. Arizona Stud. Sci. Bull.* 2(5): 5-89.
- Gossow, H., Hafner, F., Pseiner-Petrijans, S., Vonklich, G., & Watzinger, G. (1992). The status of Grey Partridge *Perdix perdix* and Rock Partridge *Alectoris graeca* populations in relation to human land use in Austria. Pp. 515-521 in: Birkan, Potts et al. (1992).
- Goszczyński, J. & Platowski, T. (1986). Diet of Common Buzzard (*Buteo buteo* L.) and Goshawk (*Accipiter gentilis*) in the nesting period. *Ekologia Polska* 34(4): 655-667.
- Grafton, R.N. (1971). Winter food of the Helmeted Guineafowl in Natal. *Ostrich* 8(Suppl.): 475-485.
- Graham, G.L., Graves, G.R., Schulerberg, T.S., & O'Neill, J.P. (1980). Seventeen bird species new to Peru from the Pampas de Heath. *Auk* 97(2): 366-370.
- Graham, D. (1980). WPA census of Cuckoo and Megapodes 1980. *J. World Pheasant Assoc.* 5: 60-63.
- Graham, D. (1983). Up-date on the World Pheasant Association Cheer Pheasant re-introduction project in Pakistan. Pp. 615-623 in: Dresser, B.L., Reece, R.W., & Maruska, E.J. eds. (1983). *Proceedings 5th World Conference on Breeding Endangered Species in Captivity*. October 9-12, 1983. Cincinnati, Ohio.
- Graham, I. (1969). Breeding of the Vulture Guineafowl (*Acridium vulturum*). *Avicult. Mag.* 75: 24-26.
- Graham, I. (1971). *Blood Pheasant. A Himalayan Adventure*. UK.
- Graham, I. (1976). The Himalayan Blood Pheasant—some further observations. *J. World Pheasant Assoc.* 1: 15-22.
- Grammetveldt, R. & Steen, J.B. (1978). Fat deposition in Spitzbergen Ptarmigan (*Lagopus mutus hyperboreus*). *Arctic* 31: 496-498.
- Grant, C.H.B. & Mackworth-Praed, C.W. (1935). On the Handsome Francolin (*Francolinus nobilis* Reichenow). *Ibis* Ser. 10, no. 5: 582-584.
- Grant, W.S. & Little, R.M. (1992a). How sedentary are Greywing Francolins *Francolinus africanus*? *Evolution* 46: 1477-1491.
- Grant, W.S. & Little, R.M. (1992b). Spatial autocorrelation analysis of gene frequencies in Greywing Francolin *Francolinus africanus* populations. *ZSA programme and abstracts*: 24(abstract).
- Grant, W.S., Little, R.M., & Crowe, T.M. (1991). Genetic variation in the Greywing Francolin *Francolinus africanus*. Page 35 in: Crowe, T.M. ed. (1991). *Proc. Conservation and Genetics Workshop*. (Abstract).
- Gratson, M.H. (1988). Spatial patterns, movements, and cover selection by Sharp-tailed Grouse. Pp. 158-192 in: Bergend & Gratson (1988b).
- Gratson, M.W. (1983). *Habitat, Mobility, and Social Patterns of Sharp-tailed Grouse in Wisconsin*. MSc thesis, University of Wisconsin, Stevens Point.
- Graves, G.R. (1992). Greater Yellow-headed Vulture (*Cathartes melambrotus*) locates food by olfaction. *J. Raptor Res.* 26: 38-39.
- Gray, A.P. (1958). *Bird Hybrids: a Check-list with Bibliography*. Commonwealth Agricultural Bureaux, Farnham Royal.
- Gray, B.T. & Prince, H.H. (1988). Basal metabolism and energetic cost of thermoregulation in Wild Turkeys. *J. Wildl. Manage.* 52(1): 133-137.
- Green, A.A. (1984). Additional Bird records from Bamingui-Bangoran National Park, Central African Republic. *Malmibus* 6(1/2): 70-72.
- Green, H.E. (1982). Reproductive behavior of female Wild Turkeys in northern Michigan. *J. Wildl. Manage.* 46(4): 1065-1071.
- Green, R. (1959). A Tasmanian nesting note on the White-breasted Sea-Eagle. *Emu* 59: 215-217.
- Green, R. (1976). Breeding behavior of Osprey *Pandion haliaetus* in Scotland. *Ibis* 118: 475-90.
- Green, R.F. (1984). Double nesting of the Red-legged Partridge *Alectoris rufa*. *Ibis* 126: 332-346.
- Greene, E.P. (1987). Information transfer at Osprey colonies: individuals discriminate between low and high quality information. *Nature* 329: 239-241.
- Greenwood, L.S. (1967). Feeding behavior of the Double-crested Kite in association with white-tailed eagles. *Auk* 84: 596-597.
- Greenway, J.C. (1967). *Extinct and Vanishing Birds of the World*. Dover Publications, New York.
- Grimes, J.E. & Imboden, D.S. (1968). Notes on stomach contents and weights of some Greater birds of prey. *Auk* 85(2): 308-309.
- von Greve, C. (1910). Der Grosse Schesadler im Kurland. *Zool. Beih.* 51: 369-372.
- Grier, J.W. (1982). Ban of DDT and subsequent recovery of reproduction in Bald Eagles. *Science* 218: 1232-1235.
- Griffin, C.R. (1976). A preliminary comparison of Texas and Arizona Harris' Hawk (*Parabuteo unicinctus*) populations. *J. Raptor Res.* 10(2): 50-54.
- Griffin, C.R. (1985). *Biogeography of the Harris Hawk Buteo swainsoni*. PhD dissertation, University of Missouri, Columbia.
- Griffin, C.R. (1989). Status and conservation of raptors in the Hawaiian Islands. Pp. 155-160 in: *Proceedings Western Raptor Management Symposium Workshop 1989*. National Wildlife Federation.
- Griffiths, C.S. (1994). Syngameal morphology and the phylogeny of the Falconidae. *Condor* 96: 127-140.
- Griffiths, F.J. (1994). *Species and Subspecies of Mammals*. *Species and Subspecies of Mammals* 54: 308-320.

- Grimes, L.G. (1971). Notes on some birds seen at Buea and on Mount Cameroon, 30 Dec. 1970 - Jan. 1971. *Bull. Nigerian Orn. Soc.* 8: 35-41.
- Grimes, L.G. (1987). *The Birds of Ghana*. BOU Check-list 9. British Ornithologists' Union, London.
- Grimmett, R.F.A. (1988). Nicobar Scrubfowl faces extinction. *Bull. Oriental Bird Club* 7: 9.
- Grimmett, R.F.A. & Jones, T.A. (1989). *Important Birds Areas in Europe*. ICBP Technical Publication 9.
- Grimmett, R.F.A. & Taylor, H. (1992). Recent bird observations from Xinjiang Autonomous region, China, 16 June to 5 July 1988. *Forktail* 7: 139-146.
- Grinnell, J., Bryant, H.C. & Storer, T.I. (1918). *The Game Birds of California*. University of California Press, Berkeley.
- Griscom, L. (1932). The distribution of bird-life in Guatemala: a contribution to the study of the origin of Central American bird-life. *Bull. Amer. Mus. Nat. Hist.* 64: 1-439.
- Grobler, J.H. (1981). Notes on the Red-breasted Sparrow Hawk *Accipiter rufiventris* in the Mountain Zebra National Park, Africa. *Ostrich* 52: 124-125.
- Groppali, R. (1987). [Records of the White-tailed Eagle, *Haliaeetus albicilla* in Lombardy (Italy) during the current century]. *Riv. Ital. Orn.* 57(1-2): 138. In Italian with English summary.
- Gross, A.O. (1928). The Heath Hen. *Mem. Boston Soc. Nat. Hist.* 6: 491-588.
- Grossman, M.J. & Hamlet, J. (1964). *Birds of Prey of the World*. Cassell, London.
- Grote, H. (1933). Zwei Flüge Junge bei *Aquila clanga* Pall. *Beitr. Fortpflanzungsbiol. Vogel* 9: 188.
- Grote, H. (1939). Beutetiere des Schelladlers. *Falco* 35: 15.
- Grote, H. (1943). Beiträge zur Biologie von Auer- und Birkhuhn. *Z. Jagdwild.* 5: 7-40.
- Grove, S.J., Hope-Jones, P., Malkinson, A.R., Thomas, D.H. & Williams, I. (1988). Black Grouse in Wales, spring 1986. *British Birds* 81: 2-9.
- Grubac, R.B. (1988). The Golden Eagle (*Aquila chrysaetos chrysaetos*) in south-eastern Yugoslavia. *Larus* 38-39: 95-135.
- Grubac, R.B. (1989). The Egyptian Vulture *Neophron percnopterus* in Macedonia. Pp. 331-334 in: Meyburg & Chancellor (1989).
- Grubac, R.B. (1991). Status and biology of the Bearded Vulture *Gypsoetus barbatus aureus* in Macedonia. Pp. 101-118 in: Chancellor & Meyburg (1991).
- Grubb, T.G., Bowerman, W.W. & Hovey, P.H. (1994). Tracking local and seasonal movements of wintering Bald Eagles *Haliaeetus leucocephalus* from Arizona and Michigan with satellite telemetry. In: Meyburg & Chancellor (1994a).
- Grubb, R.B. (1973). On the occurrence of *Gyps fulvus* and *Aegypius monachus* in the Gir Forest, J. *Bombay Nat. Hist. Soc.* 70: 198-199.
- Grubb, R.B. (1980). The griffon vultures (*Gyps bengalensis*, *G. indicus* & *G. fulvus*) of Gir Forest: their feeding habits and the nature of association with the Asiatic lion. *J. Bombay Nat. Hist. Soc.* 75(Suppl.): 1058-1068.
- Grunnert, W. (1980). Beitrag zur Systematik und Fortpflanzungsbiologie in der Gefangenschaft gehaltenen Weibchen *Ohrfasanen* *Crossophilus crossophilus* Hodgson. *Mitl.* 5: 103-116.
- Grybowski, J.A. (1983). Gyrfalcon in Oklahoma City: southernmost record for North America. *Bull. Okla. Orn. Soc.* 16: 27-29.
- Gundmundsson, F. (1960). Some reflections on Ptarmigan cycles in Iceland. Pp. 259-265 in: *Proc. XII Int. Orn. Congr. Helsinki*, 1958.
- Guhis, P. & Osborne, T. (1988). Prey selectivity of the Red-necked Falcon *Falco chicquera* in Luangwa Valley, Zambia. Pp. 307-314 in: *Proc. VI Pan-Afr. Orn. Congr.*
- Guimarães, J.R.A. et al. (1935). Notas sobre a evolução e a biologia do Mutum (*Crax fasciolata* Spix). *Bol. Biol.* 2(3): 76-81.
- Guix, J.C. (1994). *Aspectos da Frugivoria, Disseminação e Produção de Sementes por Vertebrados nas Florestas Nativas do Estado de São Paulo, Sudeste do Brasil*. MSc thesis, Barcelona University, Spain.
- Guh, J.C., Tabanez, A.A.J., da Silva, A.N., López, C., Martínez, C., Matheu, E., de Souza, F.L., Pisciotto, K.R., Bradbury, N. & Portillo, W.G. (1992). *Viagem de Reconhecimento Científico a Algumas Áreas Desconhecidas da Fauna Intercas. Estado de São Paulo, Durante o Período de 04 a 16 de Outubro de 1991*. Grupo de Estudos Ecológicos GEE. Série Documentos 4, São Paulo.
- Gullion, G.W. (1960). The ecology of Gambel's Quail in Nevada and the arid Southwest. *Ecology* 41: 518-536.
- Gullion, G.W. (1962). Organization and movements of coveys of a Gambel quail population. *Condor* 64: 402-415.
- Gullion, G.W. (1966). The use of drumming behavior in Ruffed Grouse population studies. *J. Wildl. Manage.* 30: 717-729.
- Gullion, G.W. (1967). Selection and use of drumming sites by male Ruffed Grouse. *Auk* 84: 87-112.
- Gullion, G.W. (1970). Factors influencing Ruffed Grouse populations. *Trans. North Amer. Wildl. Nat. Resour. Conf.* 35: 93-105.
- Gullion, G.W. (1977). Forest manipulation for Ruffed Grouse. *Trans. North Amer. Wildl. Nat. Resour. Conf.* 42: 449-458.
- Gullion, G.W. (1981a). Non-drumming males in Ruffed Grouse population. *Wilson Bull.* 93: 372-382.
- Gullion, G.W. (1981b). The impact of Goshawk predation upon Ruffed Grouse. *Loon* 53: 82-84.
- Gullion, G.W. (1982). Rejuvenation and maintenance of forest habitats for the American Ruffed Grouse. Pp. 11-29 in Lovel (1982).
- Gullion, G.W. (1984). *Grouse of the North Shore*. Willow Creek Press, Oshkosh, Wisconsin.
- Gullion, G.W. (1990). Ruffed Grouse use of conifer plantations. *Wildl. Soc. Bull.* 18: 183-187.
- Gullion, G.W. & Christensen, G.C. (1967). A review of the distribution of gallinaceous game birds in Nevada. *Condor* 59: 128-138.
- Gullion, G.W. & Marshall, W.H. (1968). Survival of Ruffed Grouse in a boreal forest. *Living Bird* 7: 117-167.
- Gundlach, J. (1871-1875). Neue Beiträge zur Ornithologie Cubas. *J. Zool.* 19: 265-295, 353-378; 20: 401-432; 22: 113-166, 286-303; 23: 293-340, 353-407.
- Guo Ling (1987). Breeding habits of the Daurian Partridge. *Chinese Wildlife* 36: 20-21.
- Gurchinoff, S. & Robinson, W.L. (1972). Chemical characteristics of jackpine needles selected by feeding Spruce Grouse. *J. Wildl. Manage.* 36: 80-87.
- Gurr, I. (1968). Communal roosting behaviour of the Australasian Harrier *Circus approximans* in New Zealand. *Ibis* 110: 332-337.
- Guirrola Hidalgo, M.A. (1981). Hábitos alimenticios de la Chachalaca *Oreotryx pinnifrons*. *Centronle. Rev. Soc. Mex. Ornitol.* 13(34): 209-215.
- Guirrola Hidalgo, M.A. (1985). Hábitos de Alimentación, Reproducción y Comportamiento de la Chachalaca (*Oreotryx pinnifrons*). *Av. Cracidae* en la Región Costera de Chamela, Jalisco. PhD thesis, Facultad de Ciencias, UNAM, Mexico.
- Guthery, F.S. (1986). *Beef, Brush, and Bobwhites: Quail Management in Cattle Country*. Caesar Kleberg Wildlife Research Institute, Texas A & I University, Kingsville.
- Guthery, F.S. & Koerth, N.E. (1992). Substandard water intake and inhibition of Bobwhite reproduction during drought. *J. Wildl. Manage.* 56: 760-768.
- Guthery, F.S., Koerth, N.E. & Smith, D.S. (1988). Reproduction of Northern Bobwhites in semiarid environments. *J. Wildl. Manage.* 52: 144-149.
- Gutiérrez, R.J. (1975). *Literature Review and Bibliography of the Mountain Quail (Oreortyx pictus)*. Special report, USDA Forest Service Regional Office, San Francisco, CA.
- Gutiérrez, R.J. (1980). Comparative ecology of the Mountain and California Quail in the Carmel Valley, California. *Living Bird* 18: 71-93.
- Gutiérrez, R.J. (1993). Taxonomy and biogeography of New World Quail. Pp. 8-15 in: Church, K.E. & Dailey, T.V. eds. (1993). *Quail III. National Quail Symposium*. Kansas Department of Wildlife and Parks, Pratt.
- Gutiérrez, R.J., Zink, R.M. & Yang, S.A. (1983). Genetic variation, systematic and biogeographic relationships of some galliform birds. *Auk* 100(1): 33-47.
- Guy, J. (1976). Lammereger in flight. *Bokmakkerie* 28: 57.
- Guyomarc'h, C. (1992). Structure, fonctionnement et microévolution des populations de Cailles des blés *Coturnix c. coturnix* dans le Paléarctique occidental. Pp. 387-401 in Birkan, Potts et al. (1992).
- Guyomarc'h, C. & Guyomarc'h, J.C. (1981). Influence de stimulations vocales spécifiques sur la reproduction de femelles d'oiseaux Gallinae. *Bull. Soc. Zool. Fr.* 106: 349-353.
- Guyomarc'h, C., Guyomarc'h, J.C. & Saint-Jalmes, M. (1990). Potentialités reproductrices chez les jeunes Cailles des blés *Coturnix c. coturnix*. *Cahiers d'Ethologie appliquée* 10: 125-142.
- Guyomarc'h, J.C., Guyomarc'h, C. & Saint-Jalmes, M. (1989a). Suivre les Cailles des blés? C'est possible: acquisitions récentes concernant les aptitudes sexuelles et migratoires. *Bull. mens. ONC* 114: 13-18.
- Guyomarc'h, J.C., Guyomarc'h, C. & Saint-Jalmes, M. (1989b). Analyse démographique des populations de Cailles des blés en Castille. *Bull. mens. ONC* 114: 13-18.
- Güzman, A.M.E. & Orrego, A.A. (1992). Reproductive biology and diet of Laughing Falcons in primary and modified forest habitats. Pp. 193-199 in: Whittaker & Thorstorn (1992).
- Falkenberg-Hanke, H. (1991). *Ornithologische Notizen aus dem Norddeutschen Tiefland*. *J. Orn.* 132: 121-144.
- Falkenberg-Hanke, N. (1920). A nominal list of the birds at present known to inhabit Siam. *His Ser.* 11 no. 2: 735-780.
- Falkenberg-Hanke, N. (1928). A contribution to the ornithology of northern Bolivia. *Kungl. Svenska Vetenskapsakademiens Handlingar (Tredje Serien)* 23(1).
- Falkenberg-Hanke, N. (1951). The ornithology of the Rio Puris region in western Brazil. *Kungl. Svenska Vetenskapsakademiens Handlingar (Tredje Serien)* 2(1). *Ark. Zool.* (2): 1-320.
- Falkenberg-Hanke, N. (1962). Taxonomic relationships of *Afrapavo congensis* Chapin 1936 by means of biochemical techniques. *Bull. Soc. Royal Zool. Anvers* 26: 71-79.
- Haagner, A.K. (1913a). The Secretary Bird (*Serpentarius serpentarius* Miller). *J. S. Afr. Orn. Union* 9: 107-110.
- Haagner, A.K. (1913b). The nidification of the Crowned Francolin (*Francolinus sephaena*) in captivity. *J. S. Afr. Orn. Union* 9: 63-64.
- Haas, G. (1956). Vorkommen und Verhalten des Schelladlers (*Aquila clanga*) in Württemberg. *Vogelwelt* 77: 22-24.
- Haas, G.H. (1974). *Habitat Selection, Reproduction and Movements in Female Spruce Grouse*. PhD thesis, University of Minnesota, Minneapolis.
- Habizl, C. (1978). Bemerkungen in der persischen Landschaft Gilan und auf den gilanischen Gebirgen. *Nord. Beyr* 4: 1-104.
- Hachisuka, M. (1934). *The Birds of the Philippine Islands, with Notes on the Mammal Fauna*. Vol. 2. Pt. 1. Witherby, London.
- Hachisuka, M. (1937). Note on *Afrapavo congensis* Chapin. *Bull. Brit. Orn. Club* 57: 124.
- Hachisuka, M. (1941). A new genus of Kalee Pheasants - *Delacourigallus*. *Zoologica* 26: 141.
- Hachisuka, M. (1953). On hybrids between the Green and Copper Pheasants. *Tori* 13: 40-3.
- Hachisuka, M. & Udagawa, T. (1951). Contributions to the ornithology of Formosa, part III. *Quart. J. Taiwan Mus.* 4: 1-180.
- Hadden, D. (1981). *Birds of the North Solomons*. Wau Ecology Institute, Wau, Papua New Guinea.
- Haddon, G. (1976). Black and Brown Falcons feeding ahead of moving sheep near Warren. *Aust. Birds* 11: 16-17.
- Hafer, J. (1967). Some allopatric species pairs of birds in north-west Colombia. *Auk* 84: 343-365.
- Hafer, J. (1975). *Avifauna of North-western Colombia*. South America (Francolinus sephaena) in captivity. *J. S. Afr. Orn. Union* 9: 63-64.
- Hafer, J. (1985). Avian zoogeography of the neotropical lowlands. Pp. 113-146 in: Buckley et al. (1985).
- Hafer, J. (1987). Biogeography of neotropical birds. Pp. 105-150 in: Whitmore, T.C. & Prance, G.T. eds. (1987). *Biogeography and Quaternary History in Tropical America*. Oxford Monographs, Biogeography 3. Clarendon Press, Oxford.
- Hagan, J.M. & Johnston, D.W. ed. (1992). *Ecology and Conservation of Neotropical Migrant Landbirds*. Smithsonian Institution Press, Washington & London.
- Hagan, J.M. & Walters, J.R. (1990). Foraging behavior, reproductive success, and colonial nesting in Ospreys. *Auk* 107: 506-521.
- Haker, M. & Myrberg, S. (1969). [Browsing by *Lyrurus terix* on *Pinus mugo* var. *arbores*]. *Stema* 8: 243-247. In Norwegian with English summary.
- Hakkariainen, H., Korpiakki, E., Huhta, E. & Palokangas, E. (1993). Delayed maturation in plumage colour: evidence for the female mimicry hypothesis in the Kestrel. *Behav. Ecol. Sociobiol.* 33: 247-251.
- Hale, J.B. & Dorney, R.S. (1963). Seasonal movements of Ruffed Grouse in Wisconsin. *J. Wildl. Manage.* 27: 648-656.
- Hale, P.E., Johnson, A.S. & Landers, J.L. (1982). Characteristics of Ruffed Grouse drumming sites in Georgia. *J. Wildl. Manage.* 46: 115-123.
- Hall, B.P. (1960a). The faunistic importance of the scarp of Angola. *Ibis* 102: 420-442.
- Hall, B.P. (1960b). The ecology and taxonomy of some Angolan birds (based on a collection made in 1957). *Bull. Brit. Mus. Nat. Hist.* (Zool.) 6: 367-453.
- Hall, B.P. (1961). The relationship of the guinea fowl *Agelastes meleagrides* Bonaparte and *Phasidus niger* Cassin. *Bull. Brit. Orn. Club* 81(8): 132.
- Hall, B.P. (1963). The francolins, a study in speciation. *Bull. Brit. Mus. Nat. Hist.* (Zool.) 10: 105-204.
- Hall, B.P. & Moreau, R.E. (1962). A study of the rare birds of Africa. *Bull. Brit. Mus. Nat. Hist.* (Zool.) 8: 313-378.
- Hall, D.G. (1979a). Food of the Long-crested Eagle *Lophaelagus occipitalis*. *Ostrich* 50: 256-257.
- Hall, D.G. (1979b). Records of Long-crested Eagles *Lophaelagus occipitalis* rearing two young. *Ostrich* 50: 187.
- Hall, D.G. (1982). High productive output by a pair of Long-crested Eagles *Lophaelagus occipitalis*. *Ostrich* 53: 227.
- Hall, D.G. (1992). A 16-year study of Long-crested Eagles in the Nelspruit District, South Africa. *Gabar* 7: 15-20.
- Hall, D.G., Tarboton, W.R. & Theron, F. (1991). More on the enigmatic Cuckoo Hawk. *Gabar* 6: 47-50.
- Haller, H. (1982). Raumorganisation und Dynamik einer Population des Steinadlers *Aquila chrysaetos* in den Zentralalpen. *Orn. Beob.* 79(3): 163-211.
- Halley, D.J. (1993). Population changes and territorial distribution of Common Buzzards *Buteo buteo* in the Central Highlands, Scotland. *Bird Study* 40(1): 24-30.
- Hallmann, B. (1986). Status and distribution of the genus *Aquila* in Greece. *Biologia Gallo-hellenica* 15: 171-176.
- Hallmann, B. (1994). The decline of the Imperial Eagle (*Aquila heliaca*) in Greece. In: Meyburg & Chancellor (1994b).
- Halls, L.K. ed. (1975). *Proceedings of the Third National Wild Turkey Symposium*. Texas Chapter of The Wildlife Society, Austin, TX.
- Hamas, M.J. & Zusi, R.L. (1992). Bat hunting by Merlins on Dominica. *Caribb. J. Sci.* 28: 107-109.
- Hamerstrom, F.N. (1941). *A Study of Wisconsin Prairie Grouse: Breeding Habits, Winter Foods, Endoparasites, and Movements*. PhD thesis, University of Wisconsin, Madison.
- Hamerstrom, F.N. (1963). Sharp-tailed broad habitat in Wisconsin's northern pine barrens. *J. Wildl. Manage.* 27: 793-802.
- Hamerstrom, F.N. (1966). *Harrier Hawk of the Marshes*. Smithsonian Institution Press, Washington, D.C.
- Hamerstrom, F.N. & Hamerstrom, F. (1949). Daily and seasonal movements of Wisconsin Prairie Chickens. *Auk* 66: 312-337.
- Hamerstrom, F.N. & Hamerstrom, F. (1951). Mobility of the Sharp-tailed Grouse in relation to its ecology and distribution. *Amer. Midl. Naturalist* 46: 174-226.
- Hamerstrom, F.N. & Hamerstrom, F. (1960). Comparability of some social display of grouse. Pp. 274-293 in: *Proc. XII Int. Orn. Congr. Helsinki*, 1958.
- Hamerstrom, F.N. & Hamerstrom, F. (1961). Status and problems of North American grouse. *Wilson Bull.* 73: 284-294.
- Hamerstrom, F.N. & Hamerstrom, F. (1973). *The Prairie Chicken in Wisconsin: Highlights of a Twenty-two year Study of Counts, Behavior, Movements, Turnover and Habitat*. Wisconsin Department of Natural Resources Technical Bulletin 64.
- Hamerstrom, F.N. & Hamerstrom, F. (1978). External sex characteristics of Harris' Hawks in winter. *J. Raptor Res.* 12(1/2): 1-14.
- Hamerstrom, F.N. & Weaver, J.D. (1968). Ageing and sexing Rough-legged Hawk in Wisconsin and Illinois. *Ont. Bird Band.* 4: 133-138.
- Hammerquist-Wilson, M.M. & Crawford, J.A. (1981). Response of Bobwhites to cover changes within three grazing systems. *J. Range Manage.* 34: 213-215.
- Hammerquist-Wilson, M.M. & Crawford, J.A. (1987). Habitat selection by Texas Bobwhites and Chestnut-bellied Scaled Quail in south Texas. *J. Wildl. Manage.* 51: 575-582.
- Han Demin (1990). The ecology of the Joretian Koklass Pheasant. Page 69 in: Hill et al. (1990).
- Han Demin & Yang Qishan (1993). [Ecology of Joretian Koklass Pheasant]. *Zool. Res.* 14(1): 27-34. In Chinese with English summary.
- Han Lian-xian, Yang Lan & Zheng B.-I. (1988). The sound spectrographic analyses on the calls of Lady Amherst's Pheasant *Chrysolophus amherstiae*. *Zool. Res.* 9(2): 127-132.
- Han Lian-xian, Yang Lan & Zheng B.-I. (1989). Observation on breeding ecology of Lady Amherst's Pheasant. *Zool. Res.* 10(4): 285-294.
- Han Lian-xian, Yang Lan & Zheng B.-I. (1990). Observations of wild breeding ecology of Lady Amherst's Pheasant. Page 83 in: Hill et al. (1990).
- Handrinos, G. (1985). The status of Vultures in Greece. Pp. 103-115 in: Newton & Chancellor (1985).
- Handrinos, G. & Demetropoulos, A. (1983). *Birds of Prey of Greece*. Efstathiadis Group, Athens.
- Hanedra, K. & Koizumi, M. (1965). Life history of the Black-eared Kite (*Elanus nigripes lineatus*). I. Breeding season. *Jpn. J. Ecol.* 15: 199-208, 221-228. In Japanese with English summary.
- Hanner, J. H. & Hanner, J. H. (1982). A bat eaten kestrel. *Falco dickinsoni*. *Ostrich* 53: 188-189.
- Hanner, J.A. (1978). Dickinson's Kestrel hawking birds at cane fires. *Bokmakkerie* 30: 78.
- Hannecart, F. & Letour, Y. (1980). *Oiseaux de Nouvelle Calédonie et des Loyautés*. Les Editions Cardinalis, Nouméa, Nouvelle-Calédonie.
- Hannon, S.J. (1978). *The Reproductive Cycle, Movements, and Pre-nesting Behavior of Adult and Yearling Females in a Population of Blue Grouse*. MSc thesis, University of Alberta, Edmonton.
- Hannon, S.J. (1982). *Female Aggressiveness, Breeding Density, and Mating in Willow Ptarmigan*. PhD thesis, University of British Columbia, Vancouver.
- Hannon, S.J. (1983). Spacing and breeding density of Willow Ptarmigan in response to an experimental alteration of sex ratio. *J. Anim. Ecol.* 52: 807-820.
- Hannon, S.J. (1984). Factors limiting polygyny in the Willow Ptarmigan. *Anim. Behav.* 32: 153-161.
- Hannon, S.J. (1989). Intrinsic mechanisms and population regulation in grouse - a critique. Pp. 2478-2489 in: *Proc. XIX Int. Orn. Congr. Ottawa*, 1986.

- Hannon, S.J. & Martin, K. (1992). Monogamy in Willow Ptarmigan: is male vigilance important for reproductive success and survival of female? *Anim. Behav.* 43: 747-757.
- Hannon, S.J. & Smith, J.N.M. (1984). Factors influencing age-related reproductive success in Willow Ptarmigan. *Auk* 101: 848-854.
- Hannon, S.J. & Zwickel, F.C. (1979). Probable non-breeders among female Blue Grouse. *Condor* 81: 78-82.
- Hannote, O., Bruford, M.W. & Burke, T. (1992). Multifocus DNA fingerprints in gallinaceous birds: general approach and problems. *J. Heredity* 68: 481-494.
- Hannote, O., Burke, T., Armour, J.A.L. & Jeffreys, A.J. (1991a). Cloning, characterization and evolution of Indian Peafowl *Pavo cristatus* minisatellite loci. Pp. 193-214 in: Burke, T., Dolf, G., Jeffreys, A.J. & Wolff, R. eds. (1991). *DNA Fingerprinting: Approaches and Problems*. Birkhäuser Verlag Basel, Switzerland.
- Hannote, O., Burke, T., Armour, J.A.L. & Jeffreys, A.J. (1991b). Hypervariable minisatellite DNA sequences in the Indian Peafowl *Pavo cristatus*. *Genomics* 9: 587-597.
- Hansen, A.J. (1987). Regulation of Bald Eagle reproductive rates in southeast Alaska. *Ecology* 68: 1387-1392.
- Hansen, A.J. & Hodges, J.L. (1985). High rates of nonbreeding adult Bald Eagles in southeastern Alaska. *J. Wildl. Manage.* 49: 454-458.
- Hanson, W.R. & Soikkeli, M. (1984). Group size and sex ratios among Finnish Black Grouse. *Ornis Fenn.* 61: 65-68.
- Hanssen, I. & Utne, F. (1985). Spring phenology, egg quality and chick production in Willow Ptarmigan *Lagopus lagopus* in northern Norway. *Fauna Norvegica (Ser. C. Cinclus)* 8: 77-81.
- Hantge, E. (1968). Zum beutewerb unserer Wanderfalken. *Orn. Mitt.* 20: 211-217.
- Harasathy, L. & Bagura, J. (1993). A comparison of the nesting habits of the Red-footed Falcon in colonies and solitary pairs. Pp. 80-85 in: Nicholls & Clarke (1993).
- Harasathy, L., Bagura, J. & Szitta, T. (1994a). Zur Biologie des Schreiadlers *Aquila pomarina* in Ungarn. In: Meyburg & Chancellor (1994b).
- Harasathy, L., Bagura, J. & Szitta, T. (1994b). Zum Kalinismus des Schreiadlers *Aquila pomarina* und seiner Verhinderung. In: Meyburg & Chancellor (1994b).
- Harasathy, L., Bagura, J., Szitta, T., Petrovits, Z. & Viszló, L. (1994). Biology, Status and Conservation of the Imperial Eagle (*Aquila heliaca*) in Hungary. In: Meyburg & Chancellor (1994b).
- Hård, I. & Enemar, A. (1980). Stenfalkens, *Falco columbarius* bytvald och matning under ungarnas botid. *Vår Fågelvärld* (1980): 25-34.
- Harding, E. (1982). Birds of Nissan and Pinipel Island, North Solomons Province. *Papua New Guinea Bird Soc. Newsl.* 195-196: 4-12.
- Hardy, J.W., Raitt, R.J., Orejuela, J., Webber, T. & Edinger, B. (1975). First observation of the Orange-breasted Falcon in the Yucatan Peninsula of Mexico. *Condor* 77(4): 512.
- Hardy, R. (1939). Nesting habits of the western Red-tailed Hawk. *Condor* 41: 79-80.
- Hardy, R. (1984). Comunicaciones de la Prodena 6(23 October). Unpublished newsletter.
- Harju, H.J. (1974). *An Analysis of Some Aspects of the Ecology of Dusky Grouse*. PhD dissertation, University of Wyoming, USA.
- Harlow, D.L. & Bloom, P.H. (1989). Buteos and the Golden Eagle. Pp. 102-110 in: *Proceedings Western Raptor Management Symposium and Workshop, 1989*. National Wildlife Federation, Washington, D.C.
- Harmata, A.R. & Stahlecker, D.W. (1993). Fidelity of migrant Bald Eagles to wintering grounds in southern Colorado and northern New Mexico. *J. Field Orn.* 64: 129-134.
- Harmata, A.R., Toepfer, J.E. & Gerrard, J.M. (1985). Full migration of Bald Eagles produced in northern Saskatchewan. *Blue Jay* 43: 232-237.
- Harrap, K.S. (1964). Breeding the Natal Francolin in captivity. *Avicult. Mag.* 70: 146-147.
- Harrell, B.E. (1951). *The Birds of Rancho del Cielo: an Ecological Investigation in the Oak-sagebrush Forests of Tamaulipas, Mexico*. M.A. Thesis, University of Minnesota. St. Paul, USA.
- Harris, M.P. (1982). *A Field Guide to the Birds of Galapagos*. Collins, London.
- Harris, P.M., Gerhardt, R.P. & Vázquez, M.A. (1991). Observations and food habits of nesting Great Black Hawks (*Buteogallus urubitinga ridgwayi* Gurney). Pp. 83-91 in: Whitacre et al. (1991).
- Harris, T., Dunning, J. & Hoets, D. (1990). The darker side of Bat Hawks. *Birding in SA* 42: 86-90.
- Harrison, C.J.O. (1965). Plumage patterns and behaviour in the Painted Quail. *Avicult. Mag.* 71: 176-84.
- Harrison, C.J.O. (1968). A note on the display of the Siamese Fire-backed Pheasant. *Lophura diardi*. Page 15 in: *1968 Report of the Pheasant Trust and Norfolk Wildlife Park*.
- Harrison, C.J.O. (1972). The display of Rheinart's Pheasant. *Pheasant Trust Ann. Rep.* 1971: 24-28.
- Harrison, C.J.O. (1975). The pair-bond in *Excalfactoria*. *Bull. Brit. Orn. Club* 95: 128.
- Harrison, C.J.O. & Frith, C.B. (1970). Nests and eggs of some New Guinea birds. *Emu* 70: 173-178.
- Harrison, C.J.O. & Wayre, P. (1969). The display of the Koklass Pheasant. Pp. 16-19 in: *1969 Report of the Pheasant Trust and Norfolk Wildlife Park*.
- Harrison, E.N. & Kiff, L.F. (1977). The nest and egg of the Black Solitary Eagle. *Condor* 79(1): 132-133.
- Harrison, J.G. (1955). The first occurrence of the Bateleur and Red Kite in Iraq. *Bull. Brit. Orn. Club* 75: 60-61.
- Hart, C.M., Lee, O.S. & Low, J.B. (1950). *The Sharp-tailed Grouse in Utah: its Life History, Status and Management*. Utah Department of Fish and Game, Publication 3.
- Hart, J. (1977). Observations on the breeding of the Black Sparrowhawk *Accipiter melanoleucus* in Zaire. *Ostrich* 48: 45-46.
- Hartert, E. (1912-1922). *Die Vögel der Paläarktischen Fauna*. Vol. 3. Friedländer and Sohn, Berlin.
- Hartert, E. (1904). Some notes on the plumage of the Black Sparrowhawk. *Bokmakere* 28: 61-63.
- Hartert, R. (1982). Notes on Ayres' Hawk Eagle in the Mutare area. *Honeyguide* 110: 23-27.
- Hartert, R. (1988). More on the Mutare Bat Hawks. *Honeyguide* 34: 121-122.
- Hartert, R. (1991). Notes on the juvenile plumage of the Taita Falcon and breeding conditions of an immature bird. *Ostrich* 62: 73-74.
- Hartert, R. (1992). Kori Bustard and Secretarybird electrocuted. *Honeyguide* 37: 179.
- Hartert, R. (1993). The Batoka Gorges, haven for birds of prey. *Afr. Wildl.* 47: 74-77.
- Hartert, R. & Heinrich, W. (1992). Notes on the juvenile plumage of the Taita Falcon. *Ostrich* 62: 73-74.
- Hartert, R. & Hustler, K. (1993). A less-than-annual breeding cycle in a pair of African Bat-Hawks *Macheiramphus alcinus*. *Ibis* 135(4): 456-458.
- Hartley, R. & Mundy, P.J. (1992). Management of terrestrial gamebird hunting in Zimbabwe in relation to breeding seasons. Pp. 837-846 in: Birkan, Potts et al. (1992).
- Hartley, R., Dunkley, A.S., Groenewald, A. & Bodington, G. (1993). Notes on the breeding biology, hunting behaviour and ecology of the Taita Falcon *Falco fasciatus* in Zimbabwe. Pp. 121-122 in: Wilson (1993).
- Hartzler, J.E. (1972). *An Analysis of Sage Grouse Lek Behavior*. PhD thesis, University of Montana, Missoula, USA.
- Hartzler, J.E. & Jenni, D.A. (1988). Mate choice by female Sage Grouse. Pp. 240-269 in: Bergerud & Gratton (1988b).
- Harvey, W.G. (1990). *Birds in Bangladesh*. University Press Ltd., Dhaka.
- Harwood, M. ed. (1975). *Proceedings of the North American Hawk Migration Conference, 1974*. Hawk Migration Association of North America, Washington, Connecticut, USA.
- Hartzel, J.E. (1974). Predation and the daily timing of Sage Grouse leks. *Auk* 91: 532-536.
- Hasekewer, H., Kostrewa, A. & Kostrewa, R. (1989). The breeding biology of the Kestrel *Falco tinnunculus* in eastern Westphalia, 1972-87. *J. Orn.* 129: 229-237.
- Hastings Belshaw, R.H. (1985). *Guineafowl of the World*. Nimrod Book Services, Liss, Hampshire, UK.
- Hatch, D.E. (1970). Energy conserving and heat dissipating mechanisms of the Turkey Vulture. *Auk* 87: 111-124.
- Hauke, H.H. (1991). Predation by a White-tailed Hawk and a Harris' Hawk on a Wild Turkey poult. *Condor* 73: 475.
- Haukoja, E. & Haukoja, M. (1976). Mortality rates of Finnish and Swedish Goshawks (*Accipiter gentilis*). *Finnish Game Rev.* 31: 13-20.
- Haukoja, D.A. & Smith, L.M. (1989). Lesser Prairie-chicken nest site selection and vegetation characteristics in tephrosium-treated and untreated sand shinnery oak in Texas. *Great Basin Nat.* 49: 624-626.
- Haverschmidt, F. (1947). The Black Vulture and the Caracara as vegetarians. *Condor* 49(4): 210.
- Haverschmidt, F. (1984). Feeding flights of the Southern Evergreen Kite and Blue and Yellow Macaw in Surinam. *Wilson Bull.* 66(4): 264-265.
- Haverschmidt, F. (1955). Nesting notes on *Ceryle alcyon*. *Ardea* 43: 133.
- Haverschmidt, F. (1956). Areas of Amazon Chachaco. *Ornis, notulae*. *Condor* 58: 293-294.
- Haverschmidt, F. (1957). *Falco leucurus* (Swainson) in Surinam. *Auk* 76: 808.
- Haverschmidt, F. (1959). *Nesotriton* in Surinam. *Auk* 78: 32-34.
- Haverschmidt, F. (1962). Notes on the feeding habits and food of some hawks in Surinam. *Condor* 64: 154-158.
- Haverschmidt, F. (1963). Beobachtungen an *Chondrohierax uncinatus* Temminck, in Surinam. *J. Orn. Leiden* 4: 105-106.
- Haverschmidt, F. (1968). *Notes on the breeding of the Osprey and the Harris' Hawk in London*.
- Haverschmidt, F. (1970). Notes on the Snail Kite in Surinam. *Auk* 87(3): 580-584.
- Haverschmidt, F. (1972). *Accipiter polingaster* in Surinam. *J. Orn. Leipzig* 113(3): 338-339.
- Haverschmidt, F. (1980). *Falco sparverius* in Surinam. *J. Orn. Leipzig* 104: 333-345.
- Hawthorne, A.C. (1940). The nesting of the White-tailed Kite in southern Santa Cruz County, California. *Condor* 42: 106-111.
- Hawthorne, A.C. (1942). A life history study of the White-tailed Kite. *Condor* 44(6): 267-276.
- Hay, R. (1986). *Bird Conservation in the Pacific Islands*. ICBP Study Report 7. Cambridge, England.
- Hayes, F.E. (1991). Raptor densities along the Paraguay River: Seasonal, geographical and time of day variation. *J. Raptor Res.* 25(4): 101-108.
- Hays, C. (1971). Essai sur la biologie de reproduction du Busard cendré (*Circus pygargus*) dans le Morbihan. *Ardea* 4: 1-15.
- Hayward, R.J. (1967). Fauna del noroeste argentino. I. Las aves de Guayaquil-La Rioja. *Acta Zool. Lituana* 22: 211-220.
- He Fen-qi (1992). Conservation of the Sichuan Hill Partridge in China. *PQF News* 2(Jul 1992).
- He Fen-qi & Cui Xie-zhen (1990). The gamebirds of Baoxing, Sichuan, China. Pp. 20-24 in: Hill et al. (1990).
- He Fen-qi & Lu Tai-chun (1985). [Ecology of the Chinese Monal *Lophophanes thersis* in winter]. *Zool. Res.* 6(4): 345-352.
- He Fen-qi, Gao Ying-xing & Zheng Yang-zhi (1990). Pheasant and partridge species of the Nu River Autonomous Region, North-western Yunnan, China. Page 27 in: Hill et al. (1990).
- He Fen-qi, Lu Tai-chun & Cui Xie-zhen (1988). Ecology of the Chinese Monal *Lophophanes thersis*. *Acta Zool. Sinica* 6(2): 186-192.
- He Fen-qi, Lu Tai-chun & Cui Xie-zhen (1989). Pheasant, turkey, quail, feeding activity, invertebrate abundance and vegetation structure. *J. Wildl. Manage.* 49(2): 466-472.
- Healy, W.M. & Healy, G.B. eds. (1990). *Proceedings of the Sixth National Wild Turkey Symposium*. National Wild Turkey Federation, Edgefield, South Carolina, USA.
- Healy, W.M. & Vennio, E.S. (1983). Minimum maintenance versus intensive management of clearings for Wild Turkeys. *Wildl. Soc. Bull.* 11(2): 113-120.
- Healy, W.M. & Pack, J.C. (1983). Managing seeps for Wild Turkeys in northern hardwood forest types in West Virginia. *Trans. Northeast Sect. Wildl. Soc.* 40: 19-30.
- Heck, H. (1963). The successful breeding of the King Vulture *Sarcoramphus papa* in captivity. *Zool. Garten* 27: 295-297.
- Heck, H. (1971). The artificial and hand-rearing of a King Vulture *Sarcoramphus papa* at Catskill Game Farm. *Zool. Garten* 41: 45-48.
- Hector, D.P. (1980). Our rare falcon of the desert grassland. *Birding* 12(3): 93-102.
- Hector, D.P. (1981). *The Habitat, Diet, and Foraging Behavior of the Aplomado Falcon, Falco femoralis (Temminck)*. MSc dissertation, Oklahoma State University, Stillwater, USA.
- Hector, D.P. (1985). The diet of the Aplomado Falcon (*Falco femoralis*) in eastern Mexico. *Condor* 87(3): 336-342.
- Hector, D.P. (1986). Cooperative hunting and its relationship to foraging success and prey size in an avian predator. *Ethology* 73(3): 247-257.
- Hector, D.P. (1987). The decline of the Aplomado Falcon in the United States. *Amer. Birds* 41(3): 381-389.
- Hedberg, J. (1980). *Habitat Selection by Spruce Grouse in Eastern Maine*. MSc thesis, University of Maine, Orono, USA.
- Hedley, L.A. (1967). Some observations of a communal roost of the Australasian Harrier. *Notorhin* 23: 85-89.
- Hedley, L.A. & Hedley, S. (1982). Falcons breeding in the western King Country. *Notorhin* 29: 214.
- van der Heiden, H. (1992). Secretarybird diet. *Honeyguide* 38: 119.
- Heim de Balsac, H. (1926). Exploration ornithologique de l'Ouarsenis (Contribution ornithologique de l'Algérie Septentrionale). *Oiseau et R.F.O.* 1926: 446-474.
- Heim de Balsac, H. (1935). Remarques sur la distribution et la biologie de la Gelinotte des bois dans l'Est de la France. *Alauda* 7: 227-242.
- Heim de Balsac, H. & Mayaud, N. (1962). *Les Oiseaux du Nord-ouest de l'Afrique*. Paul Lechevalier, Paris.
- Heinrich, G.H. (1958). Zur Verbreitung und Lebensweise der Vögel von Angola Part 2. *J. Orn.* 99: 322-362.
- Heinrich, P. (1991). Ergänzung Bemerkungen zur Arbeit: 'Zwanzigjährige Beobachtungen über den Schreiadler *Aquila pomarina*' von Victor Wendland. *Vogelwelt* 72: 190-197.
- Heinrich, D. (1931). Beobachtungen bei der Aufzucht eines Knapfchabel-Falkens (*Falco glutinosus*) und eines Mitis (*Mitis mitchellii*). *J. Orn.* 79: 278-283.
- Heinroth, O. (1938). Die Blaz des Bulwerfalken. *J. Orn.* 86: 1-4.
- Heinroth, O. & Heinroth, M. (1931-1933). *Die Vögel Mitteleuropas*, Vol. 4. Berlin-Lichterfelde.
- Heintzelman, D.L. (1975). *Autumn Hawk Flights: The Migrations in Eastern North America*. Rutgers University Press, New Brunswick, New Jersey.
- Heintzelman, D.S. (1964). Spring and summer Sparrow Hawk food habits. *Wilson Bull.* 76: 323-330.
- Heintzelman, D.S. & Krott, N. (1979). Zur Vogelwelt Marokkos (2). *Vogelwelt* 100: 225-227.
- Heldander, B. (1975). *Havornen i Sverige*. Bokslutningen, Uddevalla, Sweden, Svenska Naturkyddsföreningen.
- Heldander, B. (1980). Färgmarkering av havorn - en lägesrapport. *Ennen och Efter* 4: 183-187.
- Heldander, B. (1983). *Reproduction of the White-tailed Sea Eagle, Haliaeetus albicollis*. L. in Sweden, in Relation to Food and Residue Levels of Organochlorine and Mercury Compounds in the Eggs. University of Stockholm and Swedish Society for the Conservation of Nature, Stockholm.
- Heldander, B. (1990). *Sea Eagle, Haliaeetus albicollis*. Workshop. Pp. 28-135 in: Viksne, J. & Viksne, I. eds. (1990). *Baltic Birds 5. Ecology, Migration and Protection of Baltic Birds*. Proceedings of the Fifth Conference on the Study and Conservation of Migratory Birds on the Baltic Basin, Riga, October 5-10, 1987. Zinaitis Publishers, Riga.
- Heldander, B. (1990b). The international colour-ringing programme for White-tailed Sea Eagles (*Haliaeetus albicollis* L.). Pp. 136-153 in: Viksne, J. & Viksne, I. eds. (1990). *Baltic Birds 5. Ecology, Migration and Protection of Baltic Birds*. Proceedings of the Fifth Conference on the Study and Conservation of Migratory Birds on the Baltic Basin, Riga, October 5-10, 1987. Zinaitis Publishers, Riga.
- Helbig, A.J., Seibold, I., Bednarek, W., Gaucher, P., Ristow, D., Scharlau, W., Schmidt, D. & Wink, M. (1994). Phylogenetic relationships among falcon species (genus *Falco*) according to DNA sequence variation of the cytochrome b gene. In: Meyburg & Chancellor (1994a).
- Hell, P. (1964). Prispěvek k potravě některých dravců a sov s mimořádně tuhé zime 1962-1963. *Zoologické Listy* 13: 207-220.
- Hill, A. (1989). Composition of the autumn diet in the Willow Grouse *Lagopus lagopus* in the province of Oulu, northern Finland. *Siemen Rivist* 28: 79-85.
- Heilebrekers, W.P.J. & Hoogerwerf, A. (1967). A further contribution to our zoological knowledge of the island of Java (Indonesia). *Zool. Verh. Rijksmus. Nat. Hist. Leiden* 88: 1-164.
- Hillhouse, C.E. (1932). *The Birds of Idaho*. Publications of the Field Museum of Natural History (Zoological Series) 19. Chicago.
- Hillmayr, C.E. & Conover, B. (1932). Notes on some neotropical game-birds. *Auk* 49: 324-336.
- Hillmayr, C.E. & Conover, B. (1942). *Catalogue of Birds of the Americas and Adjacent Islands*. Publications of the Field Museum of Natural History (Zoological Series) 13. Pl. 1(1). Chicago.
- Hillmayr, C.E. & Conover, B. (1949). *Catalogue of Birds of the Americas and Adjacent Islands*. Publications of the Field Museum of Natural History (Zoological Series) 13. Pl. 1(4). Chicago.
- Hillmayr, C.E. & Wilson, A.C. (1948). Rates of nucleic acid evolution in pheasant-like birds determined from restriction maps. *Proc. Natl. Acad. Sci. USA* 83: 688-692.
- Hillman, M. (1963). Composition of the Finnish *Sparrowhawk* (*Accipiter nisus*) and Black Grouse (*Lyrurus tetrix*), in the autumn of 1952-1961, as revealed by a study of wings. *Finnish Game Rev.* 23: 1-124.
- Hilmenin, M. & Virano, J. (1962). Animal food of Capercaillie and Black Grouse in autumn. *Orn. Fenn.* 39: 1-12.
- Hinderson, T.B. (1960). *A Study of Blue Grouse in Summer States*. North Carolina, Washington, MS. Thesis, Washington State University, Pullman.
- Hendry, M. (1960). Call of the Secretary Bird. *J. Aviat. Nat. Hist. Soc.* 23: 217.
- Hennessey, S.P. (1978). *Endocrine Responses of the Pheasant to Human Disturbance*. MSc thesis, Utah State University, Logan, USA.
- Henny, C.J. (1983). Distribution and abundance of nesting Ospreys in the USA. Pp. 175-186 in: Bird (1983).
- Henny, C.J. & Anneer, J.T. (1978). A White-tailed Kite breeding record for Oregon. *Western Birds* 9: 131-133.
- Henny, C.J. & Kuiber, T.E. (1979). Organochlorine and mercury residues in Swainson's Hawk eggs from the Pacific Northwest. *Murrelet* 60: 2-5.
- Henny, C.J. & Wight, H.M. (1969). An endangered Osprey: population estimates, a nest-site and predation. *Auk* 86: 188-198.
- Henny, C.J. & Wight, H.M. (1972). Population ecology and environmental pollution: Red-tailed and Cooper's Hawks. Pp. 229-250 in: *Population Ecology of Migratory Birds: a Symposium*. US Fish Wildlife Service Research Report 2. Washington, D.C.
- Henny, C.J., Olson, R.V. & Fleming, T.J. (1985). Breeding chronology, molt, and measurements of *Accipiter* hawks in Northeastern Oregon. *J. Field Orn.* 56: 97-112.

- Henny, C.J., Schmid, F.C., Martin, E.M. & Hood, L.L. (1973). Territorial behavior, pesticides, and the population ecology of Red-shouldered Hawks in central Maryland, 1943-1971. *Ecology* 54: 545-554.
- Henny, G.M. (1971). *A Guide to the Birds of Ceylon*. 2nd edition. Oxford University Press, London.
- Henschel, J.R., Mendelsohn, J.M. & Simmons, R. (1991). Is the association between the Gabar Goshawks and social spiders *Stegodyphus* mutualism or theft? *Gabur* 6: 57-60.
- Heredia, B. (1990). *Ecología Invernal del Milano Real Milvus milvus (L. 1758) en el Parque Nacional de Doñana*. PhD thesis, Universidad Complutense de Madrid, Madrid, Spain.
- Heredia, B. & Clark, W.S. (1984). Kleptoparasitism by White-tailed Hawk (*Buteo albicaudatus*) on Black-shouldered Kite (*Elanus caeruleus leucurus*) in southern Texas. *J. Raptor Res.* 18: 30-31.
- Heredia, B., Alonso, J.C. & Hiraldo, F. (1991). Space and habitat use by Red Kites *Milvus milvus* during winter in the Guadalquivir marshes: a comparison between resident and wintering populations. *Ibis* 133: 374-381.
- Heredia, B., González, I.M., González, J.L. & Alonso, J.C. (1985). La emancipación y dispersión de los jóvenes de Águila Imperial en el Parque Nacional de Doñana. *Vida Silvestre* 53: 36-43.
- Heredia, R. & Donazar, J.A. (1990). High frequency of polyandrous trios in an endangered population of Lammergeiers *Gypaetus barbatus* in northern Spain. *Biol. Conserv.* 53(3): 163-171.
- Heredia, R. & Heredia, B. eds. (1991). *El Quebrantahuesos (Gypaetus barbatus) en los Pirineos. Características Ecológicas y Biología de la Conservación*. ICONA, Colección Técnica, Madrid.
- Herholdt, J.J. (1994). Aspects of the breeding ecology of the Red-necked Falcon *Falco chicuena horsbrughii* and its hunting association with the Gabar Goshawk *Micennius gabar* in the South-Eastern Kalahari. In: Meyburg & Chancellor (1994a).
- Herholdt, J.J. & de Villiers, D.J. (1989). Interesting bird observations in the Kalahari Gemsbok National Park (1988). *Mitrafia* 6: 13-18.
- Herholdt, J.J. & de Villiers, D.J. (1991). Breeding success and population density of the Bateleur *Ternophaps evadensis* in the Kalahari Gemsbok National Park. *Gabur* 6: 3-6.
- Herklots, G.A.C. (1961). *The Birds of Trinidad and Tobago*. Collins, London.
- Herman, M.F. (1980). *Spruce Grouse Habitat Requirements in Western Montana*. PhD thesis, University of Montana, Missoula.
- Herman, T.B. & Hedstrom, L. (1990). The Orange-breasted Falcon (*Falco deiraleucus*) in Costa Rica gone for thirty years? *Brenesia* 34: 153-154.
- Hermes, N. (1980). Endangered species. In: Haigh, C. ed. (1980). *Endangered Animals of New South Wales*. National Parks and Wildlife Service, Sydney, Australia.
- Hernández, J. & Rodríguez, J.V. (1988). Status de la familia Cracidae en Colombia. Unpublished report presented at the II International Cracid Symposium, Caracas, Venezuela, February/March 1988.
- Hero, J.M., Lima, A. & Joseph, L. (1992). Greater Yellow-headed Vultures feeding on a three-toed sloth in Amazonian rainforest. *Hornier* 13: 235.
- Herremans, M. (1990). Trends in the evolution of insular land birds, exemplified by the Comoro, Seychelles and Mascarene Islands. Pp. 249-260 in *Vertebrates in the tropics*. Museum Alexander Koenig, Bonn.
- Herzog, P.W. (1977a). *Dispersion and Mobility in a Local Population of Spruce Grouse (Canachites canadensis franklini)*. MSc thesis, University of Alberta, Edmonton.
- Herzog, P.W. (1977b). Summer habitat use by White-tailed Ptarmigan in southwestern Alberta. *Can. Field-Nat.* 91: 367-371.
- Herzog, P.W. (1978). Food selection by female Spruce Grouse during incubation. *J. Wildl. Manage.* 42: 632-636.
- Herzog, P.W. (1980). Winter habitat use by White-tailed Ptarmigan in southwestern Alberta. *Can. Field-Nat.* 94: 159-162.
- Herzog, P.W. & Bong, D.A. (1978). Dispersion and mobility in a local population of Spruce Grouse. *J. Wildl. Manage.* 42: 853-865.
- Herzog, P.W. & Keppie, D.E. (1980). Migration in a local population of Spruce Grouse. *Condor* 82: 366-372.
- Hewitt, D. (1992). *WPA International 1991 Census of Captive Galliformes*. Unpublished report to World Pheasant Association, Reading, UK.
- Hewitt, O.H. ed. (1976). *The Wild Turkey and its Management*. The Wildlife Society, Washington, D.C.
- Heyl, C.W. (1988a). Growth patterns and age estimation of the Cape Francolin. *S. Afr. J. Wildl. Res.* 18: 15-21.
- Heyl, C.W. (1988b). Captive rearing of the Cape Francolin and prospects for stocking. *S. Afr. J. Wildl. Res.* 18: 22-29.
- Heyland, O. (1970). [On breeding Nocturnal Curassows]. *Game Bird Breeders Gaz.* (Aug. 1970): 7.
- Heymann, E.W. (1992). Associations of tamarins (*Saguinus mystax* and *Saguinus fuscicollis*) and Double-toothed Kites (*Harpagus bidens*) in Peruvian Amazonia. *Folia Primatol.* 59(1): 51-55.
- Hickey, J.J. (1969). *Peregrine Falcon Populations, Their Biology and Decline*. University of Wisconsin Press, Madison, Wisconsin, USA.
- Hilden, O. & Kallinainen, P. (1966). Über Vorkommen und Biologie der Rohrweihe, *Circus aeruginosus* (L.), in Finland. *Ornis Scand.* 43: 85-124.
- Hilgert de Benavides, N. (1989). El Halcón Peregrino en el Ecuador (*Falco peregrinus*). *Andigena* 2: 10.
- Hill, D.A. & Ridley, M.W. (1987). Sexual segregation in winter, spring dispersal and habitat use in the Pheasant *Phasianus colchicus*. *J. Zool., London* 212: 657-668.
- Hill, D.A. & Robertson, P.A. (1988). *The Pheasant, Ecology, Management and Conservation*. Blackwell Scientific Publications Professional Books, Oxford.
- Hill, D.A., Garson, P.J. & Jenkins, D. eds. (1990). *Pheasants in Asia 1989*. World Pheasant Association, Reading, UK.
- Hill, G. (1974). Observations on a relationship between Crested Guinea fowl and vervet monkeys. *Bull. Brit. Orn. Club* 94: 68-69.
- Hill, H.M. & Wiggins, J.L. (1948). Ornithological notes from Lower California. *Condor* 50: 155-161.
- Hill, N.P. (1944). Sexual Dimorphism in the Falconiformes. *Auk* 61: 228-234.
- Hillestad, H.O. & Speake, D.W. (1970). Activities of Wild Turkey hens and poult as influenced by habitat. *Proc. Ann. Conf. Southeast Assoc. Game & Fish Comm.* 24: 244-251.
- Hillgarth, N. (1984). Social organisation of Wild Peafowl in India. *J. World Pheasant Assoc.* 9: 47-56.
- Hillgarth, N. (1990). *Parasites and Sexual Selection in Pheasants*. PhD thesis, University of Oxford, UK.
- Hillgarth, N. (1992). Parasites and female choice in Galliformes. *J. World Pheasant Assoc.* 15(1): 73-80.
- Hillgarth, N. & Dawkins, M. (1992). The two-pronged approach to studying Galliformes. *J. World Pheasant Assoc.* 15(1): 107-111.
- Hillgarth, N. & Stewart-Cox, B. (1986). The decline of the Green Peafowl *Pavo muticus*. In: Ridley (1986a).
- Hillman, C.N. & Jackson, W.W. (1973). *The Sharp-tailed Grouse in South Dakota*. Technical Bulletin 3, South Dakota Department of Game, Fish and Parks.
- Hilty, S.L. (1985). Distributional changes in the Colombian avifauna: a preliminary blue list. *Orn. Monogr.* 36: 1000-1012.
- Hilty, S.L. & Brown, W.L. (1986). *A Guide to the Birds of Colombia*. Princeton University Press, Princeton, New Jersey.
- Hines, C.J.H. (1987). The birds of Eastern Kavango, SWA/Namibia. *J. South West Afr. Sci. Soc.* 40(4): 115-147.
- Hines, C.J.H. & Rauts, W. (1989). Notes on the distribution and diet of the African Fish Eagle in north-east Namibia. *Gabur* 4: 7-10.
- Hines, J.E. (1986a). *Recruitment of Young in a Declining Population of Blue Grouse*. PhD thesis, University of Alberta, Edmonton, Canada.
- Hines, J.E. (1986b). Survival and reproduction of dispersing Blue Grouse. *Condor* 88: 43-49.
- Hines, J.E. (1987). Winter habitat relationships of Blue Grouse on Hardwicke Island, British Columbia. *J. Wildl. Manage.* 51: 426-435.
- Hintov, F. (1940). [Notes on the ecology of Steppe Eagles (*Aquila nipalensis orientalis* Cab.)]. *Rev. Microm. Epidém. Sanitat.* 13(19): 322-331. In Russian.
- Hiraldo, F. (1974). Colonias de cría y censo de los Buiteres Negros (*Aegypius monachus*) en España. *Naturalia Hispanica* 2: 1-31.
- Hiraldo, F. (1976). Diet of the Black Vulture (*Aegypius monachus*) in the Iberian Peninsula. *Doñana Acta Vertebrata* 3: 19-31.
- Hiraldo, F. (1983). Breeding biology of the Cinereous Vulture. Pp. 197-213 in: Wilbur & Jackson (1983).
- Hiraldo, F., Delibes, M. & Calderón, J. (1976). Sobre el status taxonómico del Águila Imperial Ibérica. *Doñana Acta Vertebrata* 3: 171-182.
- Hiraldo, F., Delibes, M. & Calderón, J. (1979). *El Quebrantahuesos Gypaetus barbatus (L.). Sistemática, Taxonomía, Biología, Distribución y Protección*. Monografías 22. ICONA, Madrid.
- Hiraldo, F., Delibes, M. & Calderón, J. (1984). Comments on the taxonomy of the Bearded Vulture. *Bonn. zool. Beitr.* 35(1-3): 91-95.
- Hiraldo, F., Delibes, M. & Donazar, J.A. (1991). Comparison of diets of Turkey Vultures in three regions of northern Mexico. *J. Field Orn.* 62(3): 319-324.
- Hiraldo, F., Delibes, M. & Estrella, R.R. (1989). Observations of a Zone-tailed Hawk family during the post-brooding period. *J. Raptor Res.* 23(2): 103-106.
- Hiraldo, F., Delibes, M., Bustamante, J. & Estrella, R.R. (1991). Overlap in the diets of diurnal raptors breeding at the Michilia Biosphere Reserve, Durango, Mexico. *J. Raptor Res.* 25(2): 25-29.
- Hiraldo, F., Fernández, F. & Amores, F. (1975). Diet of the Montagu's Harrier (*Circus pygargus*) in south-western Spain. *Doñana Acta Vertebrata* 2(1): 25-55.
- Hiraldo, F., Heredia, B. & Alonso, J.C. (1993). Communal roosting of wintering Red Kites *Milvus milvus* (Aves, Accipitridae): Social feeding strategies for the exploitation of food resources. *Ethology* 93(2): 117-124.
- Hiraldo, F., Negro, J.J. & Donazar, J.A. (1991). Aborted polygyny in the Lesser Kestrel *Falco naumanni* (Aves, Falconidae). *Ethology* 89: 253-257.
- Hiraldo, F., Veiga, J.P. & Máñez, M. (1990). Growth of nestling Black Kites *Milvus migrans*: effects of hatching order, weather and time of season. *J. Zool., London* 222: 197-214.
- Hirano, T., Ishida, H. & Kunitomo, T. (1988). A breeding record of the Japanese Lesser Sparrowhawk *Accipiter gularis* in the residential area of Utsunomiya. *Srix* 7: 263-266.
- Hissa, R., Rintamäki, H., Virtanen, P., Lindén, H. & Vihko, V. (1990). Energy reserves of the Capercaillie *Tetrao urogallus* in Finland. *Comp. Biochem. Physiol.* 97: 345-352.
- Hjorth, I. (1968). Significance of light in the initiation of morning display of the Black Grouse (*Lyrurus tetrix* L.). *Vitrey* 5: 39-94.
- Hjorth, I. (1970). Reproductive behavior in Tetraonidae, with special reference to males. *Vitrey* 7: 183-596.
- Hjorth, I. (1976). The divergent origin and adaptive radiation of grouse songs. *Ornis Scand.* 7: 147-157.
- Hjorth, I. (1977). The territorial system of the Capercaillie (*Tetrao urogallus*) and the influence on the leks of environmental disturbances, especially with regard to forestry and highway traffic. *Vitrey* 5: 73-77.
- Hjorth, I. (1982). Attributes of Capercaillie display song and the influence of forestry. Pp. 26-35 in: Lovel (1982).
- Hodder, K. (1993). Mediated flushing: the use of avian beaters by the Brown Falcon *Falco berigora*. *Austr. Bird Watcher* 15(4): 164-165.
- Hodson, K.A. (1976). *Some Aspects of the Nesting Ecology of Richardson's Merlin (Falco columbarius richardsoni) on the Canadian Prairies*. MSc thesis, University of British Columbia, Vancouver, Canada.
- Hoffman, D.M. (1963). The Lesser Prairie Chicken in Colorado. *J. Wildl. Manage.* 27: 726-732.
- Hoffman, D.M. (1965). *The Scaled Quail in Colorado*. Colorado Department of Game, Fish and Parks Technical Bulletin 18.
- Hoffman, R.S. (1961). The quality of the winter food of Blue Grouse. *J. Wildl. Manage.* 25: 209-210.
- Hoffman, R.W. (1981). *Population Dynamics and Habitat Relationships of Blue Grouse*. Fed. Aid in Wildl. Restor. Rep. W-37-R-34. Colorado Division of Wildlife.
- Hoffman, R.W. (1991). Spring movements, roosting activities, and home-ranging characteristics of male Merriam's Wild Turkey. *Southwestern Naturalist* 36(3): 332-337.
- Hoffman, R.W. & Braun, C.E. (1975). Migration of a wintering population of White-tailed Ptarmigan in Colorado. *J. Wildl. Manage.* 39: 485-490.
- Hoffman, R.W. & Braun, C.E. (1977). Characteristics of a wintering population of White-tailed Ptarmigan in Colorado. *Wilson Bull.* 89: 107-115.
- Hoffman, R.W. & Braun, C.E. (1978). Characteristics and status of Ruffed Grouse and Blue Grouse in Colorado. *Western Birds* 9: 121-126.
- Hoffman, R.W. & Giesen, K.M. (1983). Demography of an introduced population of White-tailed Ptarmigan. *Can. J. Zool.* 61: 1758-1764.
- Hoffman, R.W., Snyder, W.D., Miller, G.C. & Braun, R.C. (1992). Reintroduction of Greater Prairie-Chickens in northeastern Colorado. *Prairie Nat.* 24: 197-204.
- Hoffman, S.W., DeRagon, W.R. & Bednarz, J.C. (1992). *Patterns and Trends in Counts of Migrant Hawks in Western North America, 1977-1991*. Hawkwatch International, Albuquerque, New Mexico.
- Hoffmann, G. (1931). Brut eines Schelladlers in Ostpreussen. *Orn. Monatsber.* 39: 161-163.
- Hoffmann, G. (1932). Der Schelladler. *Aus der Heimat* 25: 259-262.
- Hoffmann, G. (1935). Vom Schelladler (*Aquila clanga*) in Ostpreussen. *Orn. Monatsber.* 43: 25-26.
- Hoffmann, G. (1938). Zur Brutbiologie des Kleinen Schelladlers. *Aus der Heimat* 51: 131-134.
- Hoffmeister, D.F. (1951). A western record of *Penelopina nigra*. *Auk* 68: 507-508.
- Höglund, J. (1989). Size and plumage dimorphism in lek-breeding birds: a comparative analysis. *Amer. Naturalist* 134: 72-87.
- Höglund, J., Alatalo, R.V. & Lundberg, A. (1992). The effects of parasites on male ornaments and female choice in the lek-breeding Black Grouse (*Tetrao tetrix*). *Behav. Ecol. Sociobiol.* 30: 71-76.
- Höglund, N.H. (1955). [Body temperature, activity and reproduction in the Capercaillie]. *Vitrey* 1: 1-87. In Swedish with English summary.
- Höglund, N.H. (1964a). Der Habicht *Accipiter gentilis* Linné in Fennoscandia. Beringungsergebnisse und ökologische Studien. *Vitrey* 2: 195-271.
- Höglund, N.H. (1964b). Über die ernährung des Habichts *Accipiter gentilis* Linné in Schweden. *Vitrey* 2: 271-328.
- Höglund, N.H. (1964c). Flight moulting in Tetraonids. *Vitrey* 2: 419-425.
- Höglund, N.H. (1970). On the ecology of the Willow Grouse (*Lagopus lagopus*) in a mountainous area in Sweden. *Trans. Internat. Congr. Game Biol.* 8: 118-120.
- Höglund, N.H. (1980). Studies on the winter ecology of the Willow Grouse (*Lagopus lagopus lagopus* L.). *Vitrey* 11: 249-270.
- Höglund, N.H. & Porkert, J. (1992). Possible causes for abnormal behaviour in Capercaillie (*Tetrao urogallus* L.). *Zeit. Jagdwiss.* 38: 165-170.
- Höglund, N.H. & Wiss, L.E. (1992). Diet of the Golden Eagles *Aquila chrysaetos* (L.) in Gotland, Sweden. *Ornis Fenn.* 69: 39-44.
- Hohf, R.S., Ratti, J.T. & Creteau, R. (1987). Experimental analysis of winter food selection by Spruce Grouse. *J. Wildl. Manage.* 51: 159-167.
- Hohn, E.O. (1977). The "snowshoe effect" of the feathering on ptarmigan feet. *Condor* 79: 380-382.
- Höhn, E.O. (1980). *Die Schneehühner*. 2nd ed. Neuh. Brehm-Bücherei 408. A. Ziemsen Verlag, Wittenberg Lutherstadt.
- Holbrook, H.T. & Vaughn, M.R. (1985). Influence of roads on Turkey mortality. *J. Wildl. Manage.* 49(3): 611-614.
- Holbrook, H.T., Vaughn, M.R. & Bromley, P.T. (1987). Wild Turkey habitat preferences and recruitment in intensively managed Piedmont forests. *J. Wildl. Manage.* 51(1): 182-187.
- Holdaway, R. (1994). An exploratory phylogenetic analysis of the genera of the Accipitridae, with notes on the biogeography of the family. In: Meyburg & Chancellor (1994a).
- Holder, K. & Montgomerie, R. (1993). Rock Ptarmigan (*Lagopus mutus*). No. 51 in: Poole & Gill (1993).
- Holland, D.C. (1989). An instance of carion-feeding by the Peregrine Falcon (*Falco peregrinus*). *J. Raptor Res.* 23: 184.
- Hollands, D. (1977). Field observations on the Letter-winged Kite, eastern Simpson Desert, 1974-76. *Austr. Bird Watcher* 7: 73-80.
- Hollands, D. (1979). The Letter-winged Kite irruption of 1976-77. *Austr. Bird Watcher* 8: 1-18.
- Hollands, D. (1984). *Eagles, Hawks and Falcons of Australia*. Nelson, Melbourne.
- Hollands, D. (1992). Observations on a breeding pair of Collared Sparrowhawks *Accipiter cirrocephalus*. *Austr. Bird Watcher* 14: 200-203.
- Holliday, C.S. (1965). A note on the Teita Falcon. *Puku* 3: 71-74.
- Hollom, P.A.D., Porter, R.F., Christensen, S. & Willis, I. (1988). *Birds of the Middle East and North Africa*. Poyser, London.
- Holman, F.C. (1947). Birds of the Gold Coast. *Ibis* 89: 623-650.
- Holman, J.A. (1964). Osteology of gallinaceous birds. *Quart. J. Florida Acad. Sci.* 27: 230-252.
- Holmes, D.A. (1989). Status report on Indonesian Galliformes. *Kukila* 4: 133-143 [Re-printed in *J. World Pheasant Assoc.* 15(16): 30-44 (1992)].
- Holmes, D.A. (1991). A new threat to the Green Junglefowl. *World Pheasant Assoc. News* 34: 3-6.
- Holmes, D.A. & Burton, K. (1987). Recent notes on the avifauna of Kalimantan. *Kukila* 3(1-2): 1-32.
- Holmes, D.A. & Wells, D.R. (1975). Further observations on the birds of South Thailand. *Nat. Hist. Bull. Siam Soc.* 26: 61-78.
- Holmes, P.R. (1986). The avifauna of Suru River Valley, Ladakh. *Forktail* 2: 21-41.
- Holmgren, V. (1984). Banded Eagles in intermediate plumage seen at Eilat, Israel. *Sundgrønne* 6: 76-79.
- Holsheimer, J.P. (1990). Breeding of Koklass Pheasants in captivity. Pp. 248-251 in Hill *et al.* (1990).
- Holstein, V. (1944). *Hypselvaugen (Pernis ptilorhynchus)*. Forlag, Copenhagen.
- Holstein, V. (1950). *Spurveugen Accipiter nisus (L.)*. Forlag, Copenhagen.
- Holstuijzen, A.M.A. (1980). *Prey delivery, caching, and retrieval rates in nesting Prairie Falcons*. *Condor* 92: 475-484.
- Holstuijzen, A.M.A. (1992). Frequency and timing of copulation in the Prairie Falcon. *Wilson Bull.* 104: 333-338.
- Holstuijzen, A.M.A., Doney, J.P., Hagen, J.C. & Smith, S.A. (1987). Piracy, insectivory, and cannibalism in Prairie Falcons (*Falco mexicanus*) nesting in southwestern Idaho. *J. Raptor Res.* 21: 32-33.
- Holstuijzen, A.M.A., Oosterhuis, L. & Fuller, M.K. (1985). Habitat used by migrating Sharp-shinned Hawks at Cape May Point, New Jersey, USA. Pp. 317-327 in: Newton & Chancellor (1985).
- Holyoak, D.T. (1979). Notes on the birds of Viti Levu and Taveuni. *Fiji. Emu* 79: 7-18.
- Holyoak, D.T. & Thibault, J.C. (1984). *Contribution à l'Étude des Oiseaux de Polynésie Orientale*. Mémoires du Muséum National d'Histoire Naturelle Série A, Zoologie 127. Éditions du Muséum d'Histoire Naturelle, Paris.

- Hölzinger, J., & Rösler, M. (1990). Vorkommen des Auerhuhns (*Tetrao urogallus major* C.L. Brehm, 1831) am Athos (Griechenland). *J. Orn.* 131: 95-96.
- Honsinger, W.E. (1931). [On breeding of Great Curassow]. *Aviculture* 3: 94-95.
- Hoogerwerf, A. (1948). Contribution to the knowledge of the distribution of birds on the island of Java, with remarks on some new birds. *Treubia* 19: 83-137.
- Hoogerwerf, A. (1949). Bijdrage tot de Oologie van Java. *Limosa* 22: 1-289.
- Hoogerwerf, A. (1965). Notes on Indonesian birds with special reference to the avifauna of Java and the surrounding small islands (III). *Treubia* 26: 211-291.
- Hopkinson, E. (1923). The gamebirds and pigeons of the Gambia. *Avicult. Mag.* 1: 125-131.
- Horak, G.J. (1985). *Kansas Prairie Chickens*. Wildlife Bulletin 3, Kansas Fish Game Commission.
- Horkel, J.D. (1979). *Cover and Space Requirements for Atlantic's Prairie Chicken* (*Tympanuchus cupido attwateri*) in *Refugio County, Texas*. PhD thesis, Texas A & M University Press, College Station, Texas, USA.
- Horváth, L. (1955). Red-footed Falcons on Ohat-woods, near Hortobágy. *Acta Zool. Acad. Sci. Hungar.* 1: 245-287.
- Horváth, L. (1956). The life of the Red-legged Falcon in the Otah forest. Pp. 583-587 in: *Proc. XI Int. Orn. Congr.*, Basel, 1954.
- Horváth, L. (1963). A Kék Vércse (*Falco vespertinus* L.) és a Kis Érkécs (*Lanius minor* Gm.) életénétének összehasonlító vizsgálata I. A tavaszi érkeztől az őszi elvonuláig. *Vert. Hung.* 5: 69-121; 6: 13-39.
- Horváth, L. (1975). Social pattern and behaviour between two *Falco* species (Aves). *Ann. Historico-Naturales Musei Nationalis Hungarici* 67: 327-331.
- Hostie, P. (1955a). Note sur le Paon Congolais *Afrapavo Congensis* Chapin 1936. *Bull. Corps. Lieut. Hon. Chasse Congo Belge* 4(16): 164-166.
- Hostie, P. (1955b). *Afrapavo congensis* Chapin. *Géogéat* 45: 82-84.
- Hou Y., Yang R., Liu D., Fan Q., & Wang L. (1990). [A study on the raptor migration habits in the eastern coast of China]. *Forest Research* 3(3): 207-214. In Chinese with English summary.
- Houper, R., & Lastiere, R. (1977). Captive breeding of the Salvadori's Pheasant. *J. World Pheasant Assoc.* 2: 100-103.
- Housse, R. (1926). El Aguila de Chile. *Rev. Chilena Hist. Nat.* 30: 113-121.
- Housse, R. (1935). Monografía del Balcón *Elanus leucurus leucurus* (Vieillot). *Rev. Chilena Hist. Nat.* 39: 21-24.
- Housse, R. (1938). El Tiqueo *Condalia (Phakodonta megaloptera)* (Meyen). *Rev. Chilena Hist. Nat.* 41: 131-134.
- Housse, R. (1945). *Las Aves de Chile en su Clasificación Molecular: su Vida y Costumbres*. Ediciones de la Universidad de Chile, Santiago.
- Houston, C.S. (1974). South American recoveries of Franklin's Gulls and Swainson's Hawks banded in Saskatchewan. *Blue Jay* 33: 156-157.
- Houston, C.S., & Bechard, M.J. (1983). Red-tailed Hawk distribution, Saskatchewan. *Blue Jay* 41: 99-109.
- Houston, C.S., & Miller, J.B. (1981). Record longevity of Swainson's Hawks. *J. Field Orn.* 52: 238.
- Houston, C.S., Fox, G.A., & Crawford, R.D. (1991). Unhatched eggs in Swainson's Hawk nests. *J. Field Orn.* 62: 479-485.
- Houston, D.C. (1974a). Food searching in griffon vultures. *J. East Afr. Wildl.* 12: 63-77.
- Houston, D.C. (1974b). The role of griffon vultures *Gyps africanus* and *Gyps rueppellii* as scavengers. *J. Zool., London* 172: 35-46.
- Houston, D.C. (1976). The moult of the White-backed and Rüppell's Griffon Vultures, *Gyps africanus* and *G. rueppellii*. *Ibis* 117: 474-488.
- Houston, D.C. (1976). Breeding of the White-backed and Rüppell's Griffon Vultures, *Gyps africanus* and *G. rueppellii*. *Ibis* 118: 14-40.
- Houston, D.C. (1983). The Status of European Vultures and their ranges in the Soviet Union. *Vulture News*.
- Houston, D.C. (1984). Does the King Vulture *Sarcorhamphus papa* use a sense of smell to locate food? *Ibis* 126: 67-69.
- Houston, D.C. (1985). Evolutionary ecology of Afrotropical and Neotropical vultures in forests. Pp. 856-864 in: Buckley et al. (1985).
- Houston, D.C. (1986). Scavenging efficiency of Turkey Vultures in tropical forest. *Condor* 88: 318-323.
- Houston, D.C. (1988). Competition for food between Neotropical vultures in forest. *Ibis* 130: 402-417.
- Houston, D.C. (1989). Factors influencing the timing of breeding in African vultures. Pp. 203-210 in: Meyburg & Chancellor (1989).
- Houston, D.C. (1990). A change in the breeding season of Rüppell's Griffon Vultures *Gyps rueppellii* in the Serengeti in response to changes in ungulate populations. *Ibis* 132: 36-41.
- Houston, D.C. (1993). The incidence of healed fractures to wing bones of White-backed and Rüppell's Griffon Vultures *Gyps africanus* and *G. rueppellii* and other birds. *Ibis* 135(4): 468.
- Houston, D.C. (1994). Observations on Greater Yellow-headed Vultures *Cathartes melanotus* and other *Cathartes* species as scavengers in forest in Venezuela. In: Meyburg & Chancellor (1994a).
- Houston, D.C., Hall, A., & Frey, H. (1993). The characteristics of the cosmetic soils used by Bearded Vultures *Gypis barbatus*. *Bull. Brit. Orn. Club* 113(4): 260-263.
- Howard, R.P., & Hilliard, M. (1980). Artificial nest structures and grassland raptors. *J. Raptor Res.* 14: 41-45.
- Howard, R.P., & Wolfe, M.L. (1976). Range improvement practices and Ferruginous Hawks. *J. Range Manage.* 29: 33-37.
- Howard, W.E., & Emlen, J.T. (1942). Intercoy social relationships in the Valley Quail. *Wilson Bull.* 54: 162-169.
- Howe, G. & Howe, K. (1984). Artificial insemination of Cabo's Tragopan. *J. World Pheasant Assoc.* 9: 33-38.
- Howe, H.E., & Vande Kerckhove, G.A. (1980). Nutmeg dispersal by tropical birds. *Science* 210: 925-926.
- Howe, K. (1986). Artificial insemination in Cabo's Tragopans. In: Ridley (1986a).
- Howe, W. (1989). Differences in coloration in Black Harrier young. *Bee-eater* 40: 53-55.
- Howell, S.N.G., & Webb, S. (1992a). New and noteworthy bird records from Guatemala and Honduras. *Bull. Brit. Orn. Club* 112: 42-49.
- Howell, S.N.G., & Webb, S. (1992b). A little-known cloud forest in Hidalgo, Mexico. *Euphonia* 7: 1-11.
- Howell, T.R. (1971). An ecological study of birds of the lowland pine savanna and adjacent rain forest in northeastern Nicaragua. *Living Bird* 10: 185-242.
- Howell, T.R. (1972). Birds of the lowland pine savanna of northeastern Nicaragua. *Condor* 74(3): 316-340.
- Howells, W.W., & Hustler, C.W. (1984). The status and breeding success of eagles and vultures in the Hwange National Park, Zimbabwe. Pp. 99-107 in: Mendelsohn, J.M., & Sapsford, C.W. eds. (1984). *Proceedings of the 2nd Symposium on African Predatory Birds*. Natal Bird Club, Durban.
- Howland, L.A. (1988). Observations on the Dark Chanting Goshawk. *Homeguide* 34: 178-181.
- Howman, K.C.R. (1984). Blyth's Tragopan in captivity. *J. World Pheasant Assoc.* 9: 39-47.
- Howman, K.C.R. (1993). *Pheasants of the World. Their Breeding and Management*, 2nd edition. World Pheasant Association, Reading, England & Hancock House Publishers, Blaine, Washington, USA.
- Howman, S., & Garson P.J. (1993). Pheasant surveys at Pipar, Nepal 1979-91. In: Jenkins (1993).
- Hsu Wei-shu (1989). The status of Reeves' Pheasant in China, 1988: a preliminary report. *World Pheasant Assoc. News* 26: 5-7.
- Hu Tie-qiung, I.eng Yu-yang et al. (1988). The Golden Pheasant *Chrysolophus pictus* as the official bird of Sichuan Province - a recommendation. *Sichuan J. Zool.* 7(2): 40.
- Hu Xiao-long & Wang Qi-shan (1981). The ecology of the White-crowned Long-tailed Pheasant *Symantichus reevesi*. *Wildlife* 14: 39-44.
- Huang Er-wen (1985). Conservation and exploitation of Ring-necked Pheasants *Phasianus colchicus*. *Chinese Wildlife* 12: 8-12.
- Huang Keng-shi, Ma Li, Shao Hui, & Tang T. (1989). Preliminary studies on the ecology and biology of the Himalayan Snowcock in Mt. Tian, Xinjiang, China. Pp. 33-34 in: Hui et al. (1990).
- Huang Shi-qiang & Li Fu-lai (1986a). The courtship behaviour of the male Chinese Monal *Lophophorus luyisi*. *Chinese Wildlife* 4: 32.
- Huang Shao-qiang & Li Fu-lai (1986b). Studies on the egg-laying and growth of the chick and post-juvenile moult of the Brown Eared-pheasants *Crossoptilon mitchellianum*. *La Animalia Monda* 3(1): 21-29.
- Hubbard, J.P. (1974). The status of the Gray Hawk in New Mexico. *Condor* 91: 163-166.
- Huiber, C. (1993). Nest site habitat selected by Common Buzzard (*Bubo bubo*) in southwestern France. *J. Raptor Res.* 27: 102-105.
- Hudson, G.E., Parker, R.A., Vanden Berge, J., & Lanzellotti, P.J. (1966). A numerical analysis of the modifications of appendicular muscles in various genera of gallinaceous birds. *Amer. Mus. Nat. Hist.* 76: 1-73.
- Hudson, P.J. (1985). Harvesting Red Grouse in the 1980s. *Wildfowl* 31: 319-326. In: Beason, S., & Robertson, S.F. eds. (1985). *Grouse Harvest Management*. Cuesar Kleberg Wildlife Research Institute, Kingsville, Texas.
- Hudson, P.J. (1986). *The Red Grouse. Biology and Management of a Wild Gamebird*. The Game Conservators' Trust, Fordingbridge.
- Hudson, P.J. (1986b). The effect of a parasite nematode on the breeding production of Red Grouse. *J. Anim. Ecol.* 55: 1-13.
- Hudson, P.J., & Dobson, A.P. (1990). The direct and indirect effects of the fecal nematode *Trichostrongylus axei* on Red Grouse in Lewis. J. Cragdon, D.H. & Van Riper, C. eds. (1990). *The Ecology and Management of a Gamebird*. Princeton University Press, Oxford.
- Hudson, P.J., & Newborn, D. (1990). Broad defense in a precocial species: variations in the distraction display of Red Grouse, *Lagopus lagopus scoticus*. *Anim. Behav.* 40: 254-261.
- Hudson, P.J., & Haas, M.W. eds. (1988). *Game and Wild Mammals of the World*. Blackwell Scientific Publications, Oxford.
- Hue, F., & Etcheopar, R.D. (1970). *Les Oiseaux du Proche et du Moyen Orient*. Editions N. Boube & Cie, Paris.
- Huemphner, R.A. (1981). *Winter Arboreal Feeding Behavior of Ruffed Grouse in East-central Minnesota*. MS. thesis, University of Minnesota, Minneapolis, USA.
- Huemphner, R.A., & Tester, J.R. (1988). Winter arboreal feeding behavior of Ruffed Grouse in east-central Minnesota. Pp. 122-157 in: Bergerud & Grafton (1988b).
- Huff, D.E. (1973). *A Preliminary Study of Ruffed Grouse - Aspen Nutrient Relationships*. PhD thesis, University of Minnesota, St. Paul, USA.
- Hughes, P., & Hughes, B. (1984). Notes on territorial defence and nest building behaviour of Warty-tailed Eagles. *Aust. Bird Watcher* 10: 166-167.
- Hui X.-L., Ming Z.-L., & Tian C.-y. (1993). Prevention and control of diseases of *Arctophila tungica* [sic] and *Francolinus pintadeanus*. In: Jenkins (1993).
- Hull, C. (1986). The diet of the Wedge-tailed Eagle, *Aquila audax*, breeding near Melbourne. *Condor* 10: 21-24.
- Hull, C. (1991). A comparison of the morphology of the feeding apparatus in the Peregrine Falcon, *Falco peregrinus*, and the Brown Falcon, *F. berigora* (Falconiformes). *Aust. J. Zool.* 39: 67-76.
- Hull, C. (1993). Prey dismantling techniques of the Peregrine Falcon *Falco peregrinus* and Brown Falcon *Falco berigora*: their relevance to optimal foraging theory. In: Olsen (1993a).
- Huismans, J.L.J. (1963). The comparative myology of the pelvic limb of *Afrapavo congensis* Chapin 1936. *Bull. Soc. Royal Zool. Antverp* 26: 25-61.
- Humphrey, P.S., Bridge, D., Reynolds, P.W., & Peterson, R.T. (1970). *Birds of Isla Grande (Tierra del Fuego)*. Museum of Natural History, University of Kansas, Lawrence, Kansas.
- Humphrey, P.S., Pefaur, J.E., & Rasmussen, P.C. (1993). Avifauna of three holocene cave deposits in southern Chile. *Oec. Pop. Mus. Nat. Hist. Univ. Kansas* 154: 1-37.
- Humphrey, S.R., & Bain, J.R. (1990). *Endangered Animals of Thailand*. Sandhill Crane Press, Gainesville, Florida.
- Hunag, E.W. (1985). Conservation and exploitation of the Ring-necked Pheasant. *Chinese Wildlife* 24: 8-12.
- Hungerford, C.R. (1962). Adaptations shown in selection of foods by Gambel's Quail. *Condor* 64: 213-219.
- Hungerford, C.R. (1964). Vitamin A and productivity in Gambel's Quail. *J. Wildl. Manage.* 28: 141-147.
- Hunt, C. (1978). Observations on the Greater Kestrel. *Bokmakierre* 30: 35.
- Hunt, W.G., Driscoll, D.E., Bianchi, E.W., & Jackman, R.E. (1992). *Ecology of Bald Eagles in Arizona*. Part A. Population Overview. Report to US Bur. Reclaim. Biosystems Analysis, Inc., Santa Cruz, California.
- Hunt, W.G., Jackman, R.E., Jenkins, J.M., Thelander, C.G., & Lehmann, R.N. (1992). Northward post-fledging migration of California Bald Eagles. *J. Raptor Res.* 26: 19-23.
- Hunter, D., Douglas, M.G., Stead, D.E., Taylor, V.A., Alder, J.R., & Carter, A.T. (1979). A breeding record and some observations of the Taita Falcon *Falco taitanus* in Malawi. *Ibis* 121: 93-94.
- Hupp, J.W., & Braun, C.E. (1989a). Topographic distribution of Sage Grouse foraging in winter. *J. Wildl. Manage.* 53: 823-829.
- Hupp, J.W., & Braun, C.E. (1989b). Endogenous reserves of adult male Sage Grouse during courtship. *Condor* 91: 266-271.
- Hupp, J.W., & Braun, C.E. (1991). Geographic variation among Sage Grouse in Colorado. *Wilson Bull.* 103: 255-261.
- Hurst, G.A. (1978). Effects of controlled burning on Wild Turkey poult food habits. *Proc. Ann. Conf. Southeast. Assoc. Fish & Wildl. Agencies* 32: 30-37.
- Hurst, G.A. (1980). Histomoniasis in Wild Turkeys in Mississippi. *J. Wildl. Diseases* 16(3): 357-358.
- Hussain, K.Z. (1959). Notes on the taxonomy and zoogeography of the genus *Elanus*. *Condor* 61: 153-154.
- Hussain, M.A. (1990). Re-introduction of Cheer Pheasant in Mangalia Hills National Park, Pakistan: release of Cheer poult and their survival (1978-1989). Pp. 228-232 in: Hill et al. (1990).
- Hussain, M.A., & Bhalla, H.R. (1937). Some birds of Lyaalpur and their food. *J. Bombay Nat. Hist. Soc.* 39: 831-842.
- Hussain, M., Young, L., & Asker, G. (1986). The Cheer Pheasant reintroduction project. In: Ridley (1986a).
- Hustler, K. (1976). Notes on the Black Harrier. *Bokmakierre* 28: 73.
- Hustler, K. (1983a). Breeding biology of the Peregrine Falcon in Zimbabwe. *Ostrich* 54: 161-171.
- Hustler, K. (1983b). Incubatory behaviour of the Bat Hawk. *Ostrich* 54: 156-160.
- Hustler, K. (1983c). Breeding biology of the Greater Kestrel. *Ostrich* 54: 129-140.
- Hustler, K. (1985). Status of the Buleur in Zimbabwe. *Homeguide* 31: 137-144.
- Hustler, K. (1988). Why are Peregrines so rare in South Africa. *Ostrich* 58: 86-88.
- Hustler, K., & Howells, W.W. (1987). Breeding periodicity, productivity and conservation of the Martial Eagle. *Ostrich* 58: 135-138.
- Hustler, K., & Howells, W.W. (1988a). Breeding biology of the Hooded and Lappet-faced Vultures in the Hwange National Park. *Homeguide* 34: 109-115.
- Hustler, K., & Howells, W.W. (1988b). Breeding biology of the White-headed Vulture in the Hwange National Park. *Zimbabwe Ostrich* 59: 21-24.
- Hustler, K., & Howells, W.W. (1988c). The effect of primary production on breeding success and habitat selection in the African Hawk Eagle. *Condor* 90: 583-587.
- Hustler, K., & Howells, W.W. (1989). Habitat preference, breeding success and the effect of primary productivity on Tawny Eagles *Aquila rapax* in the tropics. *Ibis* 131: 33-40.
- Huyle, J., & Nicholson, E.M. (1963). Lammegereit *Gypis barbatus* breaking bones. *Ibis* 105: 106-107.
- Iankov, P., Khristov, K., & Avranov, S. (1994). Changes in status of the Black Vulture *Aegypius monachus* in Bulgaria for the period 1980-1990. In: Meyburg & Chancellor (1994a).
- Iankov, P., Petrov, T., Michel, T., Profirov, L. (1994). Past and present status of the Lesser Kestrel *Falco naumanni* in Bulgaria. In: Meyburg & Chancellor (1994a).
- Iapichino, C., & Massa, B. (1989). *The Birds of Sicily*. British Ornithologists' Union, London.
- Uthering, H. (1885). [On *Pipile jaychiana*, migration]. *Geogr. Orn.* (1885): 97-184.
- Jacey, A.H., & Hunt, V.E. eds. (1985-1986). *Hodgson's der Vire - der Sonnentauern A. Ziemsen Verlag, Wittenberg*.
- Ulmer, H. (1992). Effect of roads with heavy traffic on Grey Partridge *Perdix perdix* density. Pp. 467-480 in: Birkan, P. et al. (1992).
- Ilyinskii, I.V., Fetisov, S.A., & Fodorov, V.A. (1990). [Materials on the biology of Marsh Harrier in NW of the RSFSR]. *Vestn. Lening. Univ. Biol.* (1990-3): 3-10. In Russian with English summary.
- Immelmann, K., & Böhner, J. (1984a). Beobachtungen am Thermometerhuhn (*Lepus ocellatus*) in Australien. *J. Orn.* 125: 141-155.
- Immelmann, K., & Böhner, J. (1984b). Ruffdutt beim Thermometerhuhn (*Lepus ocellatus*). *Verh. Dtsch. Zool. Ges.* 77: 295.
- Indrawan, M. (1992a). News on the Maleo colony at Balarang, eastern Sulawesi. *Indonesian Megapode News* 6(2): 13-14.
- Indrawan, M. (1992b). Notes on Green Peafowl. *J. World Pheasant Assoc.* 15(16): 93-97.
- Indrawan, M., & van Balen, B. (1991). Close watch on Green Peafowl among the highlands of Java. *World Pheasant Assoc. News* 32: 28-31.
- Indrawan, M., Fujita, M.S., Masala, Y., & Pesik, L. (1992). Status and conservation of the Sula Sembilang *Megapodius bernsteini* report from Banggai Islands, Indonesia. Draft report for EMU/ICI Hani PIPA Borneo Research. I.A. (1992). *Buku dan Atlas Burung dan Hewan di Kepulauan Banggai*. Penerbit Pustaka, Pustaka, Pustaka.
- Inskeep, C. (1989). The ornithological importance of Khatpal National Park, Nepal. *Forktail* 5: 49-60.
- Inskeep, C., & Inskeep, T. (1985). *A Guide to the Birds of Nepal*. Croom Helm, London & Sydney.
- Inskeep, C., & Inskeep, T. (1986). Some ornithological notes on a visit to Nepal. *Forktail* 1: 27-29.
- Inskeep, C., & Inskeep, T. (1993a). Birds recorded during a visit to Bhutan in autumn 1991. *Forktail* 8: 97-112.
- Inskeep, C., & Inskeep, T. (1993b). Birds recorded during a visit to Bhutan in spring 1993. *Forktail* 9: 123-147.
- Inskeep, C. (1993). Habitat use and relative abundance of the Bat Falcon and other birds in a tropical forest. *Chapman, Mexico J. Raptor Res.* 27(1): 73-74.
- Inigo-Elias, E.E., Ramos, M., & González, F. (1987). Two recent records of neotropical eagles in southern Veracruz. *Mexico Condor* 89(3): 671-672.
- Iqbal, S.M. (1990). *Studies on the Ecology and Behaviour of White-necked Kestrel (Falco tinnunculus) in the Himalayas*. PhD thesis, University of Kashmir, India.
- Iqbal, S.M. (1993). Patterns of habitat use by White-necked Kestrel at two sites in the Indian Himalayas in 1988-89. In: Jenkins (1993).
- Irvine, J. (1985). *Notes on the Ecology and Behaviour of White-necked Kestrel (Falco tinnunculus) in the Himalayas*. PhD thesis, University of Kashmir, India.
- Irvine, J.A., Franklin, W.L., & Johnson, W.F. (1967). Diet of the White-necked Kestrel in southern Chile. *J. Raptor Res.* 24(3): 41-46.
- Iribarren, J.L., & Rodríguez Arceba, A. (1998). Sobre la distribución y hábitos de *Urocyon v. pennsylvanicus* (Canis) en Navarra. *Publ. Mus. Univ. Navarra (Ser. Zoológica)* 17: 1-27.

- Irisov, F.A. (1991). *Altai Simeevsk: Distribution, Biology and Maintenance in Captivity*. Nauka, Novosibirsk.
- Irving, L., West, C.G. & Peyton, L.J. (1967a). Winter feeding program of Alaska Willow Ptarmigan shown by crop contents. *Candor* 69: 69-77.
- Irving, L., West, C.G., Peyton, L.J. & Paneak, S. (1967b). Migration of Willow Ptarmigan in arctic Alaska. *Arctic* 20: 77-85.
- Irwinn, M.P.N. (1971). The Red-necked and Swainson's Francolins in Rhodesia. *Honeyguide* 66: 29-33.
- Irwinn, M.P.N. (1981). *The Birds of Zimbabwe*. Quest Publishing, Harare.
- Irwinn, M.P.N., Benson, C.W. & Steyn, P. (1982). The identification of the Ovambo and Red-breasted Sparrow Hawks in south central Africa. *Honeyguide* 111/112: 28-44.
- Ismann, P., Lacan, F., Mougin, J.L., Prevost, J. & van Beveren, M. (1970). Note préliminaire sur l'écologie du Petit Coq de Bruyère *Lyrurus tetrix tetrix* dans le Vallon d'Aussois. *Trav. Scient. Par. Nat. Vanoise* 1: 163-182.
- Islam, K. (1987). Status and distribution of the Western Tragopan in northeastern Pakistan. Pp. 44-51 in: Savage & Ridley (1987).
- Islam, K. (1991). In search of the Western Tragopan. *World Pheasant Assoc. News* 31: 11-15.
- Islam, K. & Crawford, J.A. (1985). Brood habitat and roost sites of Western Tragopan in northeastern Pakistan. *J. World Pheasant Assoc.* 10: 7-14.
- Islam, K. & Crawford, J.A. (1986). Summary of Western Tragopan project in Pakistan with recommendations for conservation of the species. In: Ridley (1986a).
- Islam, K. & Crawford, J.A. (1993). Sex ratio in Western Tragopans and its implications for population estimation. Pp. 131-133 in Jenkins (1993).
- Ismagilov, M.I. (1962). [On the breeding period in the Steppe Eagle in central Kazakhstan]. Pp. 3-4 in: *Mut. III Vsesoyuz. ornit. konf. L'vov*, Part 2. In Russian.
- Itäimies, J. & Korpimäki, E. (1987). Insect food of the kestrel *Falco tinnunculus* during breeding in western Finland. *Aquila Ser. Zool.* 25: 21-31.
- Ivanov, V.V. (1952). [New information on the ecology of the Steppe Eagle]. *Privody* 12: 123. In Russian.
- Ivanovskiy, V.V. (1993a). [Materials on comparative ecology of the Greater Spotted Eagle (*Aquila clanga*) and Lesser Spotted Eagle (*Aquila pomarina*)]. Pp. 15-25 in: *ONP NPEC "Venus-eco" & Inst. of Zool. Ac. Sci. Belarus*. In Russian.
- Ivanovskiy, V.V. (1993b). [The Greater Spotted Eagle in the Vitebsk Region]. Pp. 213-215 in: *Problems of the Conservation of Biological Diversity in Belarus*. Abstr. of Intern. Scient. Pract. Conf. Minsk. In Russian.
- Ivanter, E.V. (1962). [On the biology of the Hazel Hen in Karelia]. *Ornitologiya* 4: 87-98. In Russian.
- Ivanter, E.V. (1963). [The Hazel Hen in Karelia]. *Ornitologiya* 6: 68-80. In Russian.
- Ivanter, E.V. (1965). [Ecology and densities of Capercaillie in Karelia]. Pp. 139-141 in: *Mut. IV Vsesoyuz. ornit. konf.* In Russian.
- Ivanter, E.V. (1974). [Capercaillie and Willow Grouse in Karelia]. *Ornitologiya* 12: 206-226.
- Izor, R.J. (1985). Sloths and other mammalian prey of the Harpy Eagle. Pp. 343-346 in: Montgomery, G.G. ed. (1985). *The Evolution and Ecology of Armadillos, Sloths, and Vermilingues*. Smithsonian Institution Press, Washington, D.C.
- van Jaarsveld, J. (1988). African Goshawks and European Hobbies bat-hawking. *Gabur* 3: 29-31.
- Jabouille, P. (1926). La reproduction du Rheinarier ocellé. *Oiseau et RFO* 7: 227-9.
- Jabouille, P. (1930). Le phénix fabuleux de la Chine et le Faisan ocellé d'Annam. *Oiseau et RFO* 11: 220-32.
- Jackson, F.J. (1910). East Africa and Uganda francolins. *J. East Afr. & Uganda Nat. Hist. Soc.* 1: 7-23.
- Jackson, F.J. (1911). Gamebirds of the East Africa and Uganda Protectorates. *J. East Afr. & Uganda Nat. Hist. Soc.* 2: 60-74.
- Jackson, F.J. & Selator, W.L. (1938). *The Birds of Kenya Colony and the Uganda Protectorate*. Gurney and Jackson, London.
- Jackson, P. (1987). Animaux et plantes au bord de l'extinction et ce que nous pouvons faire. *IUCN Bull.* 18: 1-3; DS1-DS16.
- Jaeschke, J. (1987). *Le Régime Alimentaire du Grand Tétras (Tetrao urogallus L.) et de la Gélinotte des Bois (Bonasa bonasia) dans le Jura*. PhD thesis, Université de Bourgogne, France.
- Jacobi, E.F. (1970). Die Zucht von Talegallühnern (*Alectura lathami* Gray) mit elektrischer Bruthitze. *Zool. Gart.* 39: 129-132.
- Jacobsen, E.F., White, C. & Emison, W.B. (1983). Molted adaptations for Rock Ptarmigan on Amchitka island, Alaska. *Candor* 85: 420-426.
- Jahn, H. (1942). Zur Ökologie und Biologie der vogel Japans. *J. Orn.* 90: 6-302.
- Jakle, M.D. & Gatz, T.A. (1984). Harris Hawks feeding on fish. *Southwestern Naturalist* 29(4): 506.
- Jaksic, F.M. & Delibes, M. (1987). A comparative analysis of food-niche relationships and trophic guild structure in two assemblages of vertebrate predators differing in species richness: causes correlations, and consequences. *Oecologia* 71: 461-472.
- Jaksic, F.M. & Jiménez, J.E. (1986). The conservation status of raptors in Chile. Pp. 95-104 in: Chancellor & Meyburg (1986).
- Jaksic, F.M., Greene, H.W. & Yáñez, J.L. (1981). The guild structure of a community of predatory vertebrates in central Chile. *Oecologia* 49: 21-28.
- Jaksic, F.M., Jiménez, J.E., Castro, S.A. & Feinsinger, P. (1992). Numerical and functional response of predators to a long-term decline in mammalian prey at a semi-arid Neotropical site. *Oecologia* 89: 90-101.
- Jaksic, F.M., Rozzi, R., Labra, A. & Jiménez, J.E. (1987). The hunting behavior of Black-shouldered Kites (*Elanus caeruleus leucurus*) in central Chile. *Candor* 89: 907-911.
- Jaksic, F.M., Silva, S., Marquet, P.A. & Contreras, L.C. (1991). Food habits of Gurney's Buzzard in pre-Andean ranges and the high Andean plateau of northernmost Chile. *J. Raptor Res.* 25(4): 116-119.
- Jaksic, F.M., Yáñez, J.L. & Schlatter, R.P. (1980). Prey of the Harris' Hawk in Central Chile. *Auk* 97(1): 196-198.
- Jakubas, W.J. & Gullion, G.W. (1991). Use of quaking aspen flower buds by Ruffed Grouse: its relationship to grouse densities and bud chemical composition. *Candor* 93: 473-485.
- James, A.H. (1986). Review of taxonomic characters in African buzzards Genus *Buteo*. *Beaufortia* 36: 1-12.
- James, A.H. (1988). Geographic variation in the Buzzard *Buteo buteo* L.: *japonicus*-group (Aves: Accipitridae). *Beaufortia* 38 (4): 57-74.
- James, C. & Hislop, G. (1988). Status and conservation of two cracid species, the Pawi or Trinidad Piping Guan (*Pipile pipile*) and the Coerico (*Oreortyx ruficauda*) in Trinidad and Tobago. Unpublished report presented at the II International Cracid Symposium, Caracas, Venezuela, February/March 1988.
- James, P.C. & Oliphant, L.W. (1986). Extra birds and helpers at the nest of Richardson's Merlin. *Candor* 88: 533-534.
- James, P.C., Smith, A.R., Oliphant, L.W. & Warkentin, I.G. (1987). Northward expansion of the wintering range of Richardson's Merlin. *J. Field Orn.* 58: 112-117.
- Jamieson, I.G. (1982). *Spatial Patterns and Behavior of Selected Blue Grouse and their Relation to Recruitment into the Breeding Population*. MSc thesis, University of Alberta, Edmonton, Canada.
- Jamieson, I.G. (1983). Seasonal changes in spatial patterns and behavior of yearling Blue Grouse on the breeding range. *Can. J. Zool.* 61: 2777-2780.
- Jamieson, I.G. (1985). Behavior of yearling male Blue Grouse and its relation to delayed breeding. *Wilson Bull.* 97(2): 71-77.
- Jamieson, I.G. & Seymour, N.R. (1983). Inter- and intra-specific agonistic behavior of Ospreys near their nest site. *Can. J. Zool.* 61: 2199-2202.
- Jamieson, I.G. & Zwickel, F.C. (1983a). Spatial patterns of yearling male Blue Grouse and their relation to recruitment into the breeding population. *Auk* 100: 653-657.
- Jamieson, I.G. & Zwickel, F.C. (1983b). Dispersal and site fidelity in Blue Grouse. *Can. J. Zool.* 61: 570-573.
- James, S.W. (1984). Influences of territory composition and interspecific competition on Red-tailed Hawk reproductive success. *Ecology* 65: 862-868.
- James, S.W. (1985). Habitat selection in raptorial birds. Pp. 159-188 in: Cody, M.L. ed. (1985). *Habitat Selection in Birds*. Academic Press, NY.
- Junik, C.A. & Mosher, J.A. (1982). Raptor breeding biology in the central Appalachians. *J. Raptor Res.* 16: 18-24.
- Junkovitz, M. (1976). Tawny or Steppe Eagle? *Boknakiene* 28: 64-65.
- Juntsov, B. (1976). Plio-Pleistocene bird remains from the Carpathian basin. I. Galliformes. I. Tetraonidae. *Aquila* 82: 13-36.
- Janosy, D. (1985). Operations aimed at saving the second chick of the Lesser Spotted Eagle *Aquila pomarina* in Hungary. *World Working Group on Birds of Prey News*, 3: 97-98.
- Juntsov, B. (1989). [Pli-Pleistocene distribution of the Egyptian Vulture (*Neophron percnopterus*) in the Mediterranean region]. *Fragmenta Mineralogica et Palaeontologica* (14): 121-125. In German with English summary.
- Jarvis, D.L., Oosterhuis, J.E., Allen, J.L., Anderson, M.P., Kelts, D.G. & Wiemeyer, S.N. (1986). Lead poisoning in free-ranging California Condors. *J. Amer. Vet. Med. Assoc.* 155: 1052-1056.
- Jarmy, E. (1960). An Brutplätzen des Lannerfalken (*Falco biarmicus erlangeri* Kleinschmidt) in einer Kieswüste der inneren Sahara (Nordrand des Sierr Tibets) zur Zeit des Frühjahrzuges. Pp. 343-352 in: *Proc. XII Int. Orn. Congr. Helsinki*, 1958.
- Jaramillo, A.P. (1993). Wintering Swainson's Hawks in Argentina: food and age segregation. *Candor* 95: 475-479.
- Jarvis, C. & Medway, Lord. (1968). Sideways throwing and associated reproductive behaviour in the Crestless Fireback Pheasant, *Lophura erythrophthalma*. Pp. 13-14 in: 1968 *Report of Ornamental Pheasant Trust and Norfolk Wildlife Park*.
- Jarvis, M.J. & Crichton, J. (1978). Notes on Longcrested Eagles in Rhodesia. Pp. 17-24 in: Kemp, A.C. ed. (1978). *Proceedings of a Symposium on African Predatory Birds*. Northern Transvaal Ornithological Society, Pretoria.
- Jarvis, M.J., Currie, M.H. & Palmer, N.G. (1980). Food of Crowned Eagles in the Cape Province of South Africa. *Ostrich* 51: 215-218.
- Jaubert, J.P. (1989). Le Vautour fauve. *Bibliothèque de Travail* 1009: 1-29.
- Javed, S. & Rahmani, A.R. (1991). Swamp Francolin in the north Indian terai. *World Pheasant Assoc. News* 34: 15-18.
- Jeffery, R.D. (1977). Three nests of the Cuckoo Falcon in Rhodesia. *Honeyguide* 90: 33-34.
- Jeggo, D. (1972). Courtship displays of the Congo Peacock *Afrapapa congensis*. Pp. 43-49 in: 9th Annual Report Jersey Wildlife Preservation Trust.
- Jeggo, D. (1973). Preliminary notes on the Palawan Peacock Pheasant (*Polyplectron emphanum*) breeding programme at the Jersey Zoological Park. Pp. 76-81 in: 10th Annual Report Jersey Wildlife Preservation Trust.
- Jeggo, D. (1975). Breeding the Palawan Peacock Pheasant at the Jersey Zoological Park. *Avicult. Mag.* 81: 8-12.
- Jehl, J.R. (1968). Foraging behavior of *Geranospiza nigra*, the Blackish Crane-Hawk. *Auk* 85(3): 493-494.
- Jehl, J.R. & Parkes, K.C. (1982). The status of the avifauna on the Revillagigedo Islands, Mexico. *Wilson Bull.* 94: 1-19.
- Jenkins, A. (1984). Hunting behaviour and success in a pair of Black Eagles. *Ostrich* 55: 102-103.
- Jenkins, A.R., Wagner, S.T. & Hoffman, L. (1992). First breeding record of the Taita Falcon in South Africa. *Ostrich* 62: 78.
- Jenkins, D. (1957). The breeding of the Red-legged Partridge. *Bird Study* 4: 97-100.
- Jenkins, D. (1961). Social behaviour in the Lappet *Perdix perdix*. *Ibis* 103A: 155-188.
- Jenkins, D. ed. (1991). *5th International Grouse Symposium*. Held in 1990. Special edition Omis Scandinavica July/September 1991.
- Jenkins, D. ed. (1993). *Pheasants in Asia 1992*. World Pheasant Association, Reading, UK.
- Jenkins, D. ed. (1994). *6th International Grouse Symposium*. Held in 1993. World Pheasant Association, Reading, UK.
- Jenkins, D., Watson, A. & Miller, G.R. (1963). Population studies on Red Grouse, *Lagopus lagopus scoticus* (Lath.) in north-east Scotland. *J. Anim. Ecol.* 32: 317-376.
- Jenkins, D., Watson, A. & Miller, G.R. (1964). Predation and Red Grouse populations. *J. Appl. Ecol.* 1: 183-195.
- Jenkins, D., Watson, A. & Miller, G.R. (1967). Population fluctuations in the Red Grouse *Lagopus lagopus scoticus*. *J. Anim. Ecol.* 36: 97-122.
- Jenkins, J.M. & Agouin, C. (1981). Status of candidate endangered bird species on Saipan, Tinian and Rota of the northern Mariana Islands. *Micronesica* 17: 184-186.
- Jenkins, M.A. (1978). Gyrfalcon nesting behavior from hatching to fledging. *Auk* 95: 122-127.
- Jenkins, R.E. (1970). Food habits of wintering Sparrow Hawks in Costa Rica. *Wilson Bull.* 82: 97-98.
- Jenkinson, M.A. & Tuttle, M.D. (1976). *Accipiter poliogaster* from Peru, and remarks on two collecting localities named "Sarayacu". *Auk* 93(1): 187-189.
- Jennings, M.C. (1981). *Birds of the Arabian Gulf*. George Allen & Unwin, London.
- Jennings, M.C. (1982). A breeding record of the Lappet-faced Vulture from Arabia. *Sandgrouse* 4: 114-115.
- Jenny, J.P. (1989). Observations of the Orange-breasted Falcon (*Falco deiroleucus*) in the northern Perén from 1979-1989. Pp. 93-97 in: Burnham *et al.* (1989).
- Jenny, J.P. & Burnham, W.A. (1987). Preliminary observation on the biology of the Orange-breasted Falcon (*Falco deiroleucus*). In: *III Congreso de Ornitología Neotropical. Resúmenes*. Unpublished.
- Jenny, J.P. & Cade, T.J. (1986). Observations on the biology of the Orange-breasted Falcon *Falco deiroleucus*. Pp. 119-124 in: Chancellor & Meyburg (1986).
- Jensen, E.P. & Stuart, S.N. (1985). The origin and evolution of the Cameroon montane forest avifauna. Pp. 181-191 in: Schuchmann (1985).
- Jensen, J.V. & Kirkeby, J. (1980). *The Birds of the Gambia. An Annotated Checklist & Guide to Localities in the Gambia*. Aros Nature Guides.
- Jensen, L. & Ryder, R.A. (1965). Breeding behavior of the White-tailed Ptarmigan near Aspen, Colorado. *Colorado-Wyoming Acad. Sci.* 5: 52-53.
- Jensen, R.A.C. (1972). The Steppe Eagle *Aquila nipalensis* and other termite-eating raptors in South West Africa. *Madoqua* 1: 73-76.
- Jiang Zhi-hua (1979). Preliminary observations on the ecology of the Tibetan Eared-pheasant *Crossoptilon crossoptilon*. *Chinese J. Zool.* 3: 14-16.
- Jiménez, J.E. (1993). Notes on the diet of the Aplomado Falcon (*Falco femoralis*) in noncentral Chile. *J. Raptor Res.* 27(3): 161-163.
- Jiménez, J.E. & Jaksic, F.M. (1988). Ecology and behavior of southern South American Cinereous Harriers (*Circus cinereus*). *Rev. Chilena Hist. Nat.* 61(2): 199-208.
- Jiménez, J.E. & Jaksic, F.M. (1989). Behavioral ecology of Gray Eagle-buzzards, *Geranoaetus melanoleucus*, in central Chile. *Candor* 91(4): 913-921.
- Jiménez, J.E. & Jaksic, F.M. (1990a). Diet of Gurney's Buzzard in the Puna of northernmost Chile. *Wilson Bull.* 102(2): 344-346.
- Jiménez, J.E. & Jaksic, F.M. (1990b). Historia natural del águila *Geranoaetus melanoleucus*: una revisión. *Hornoro* 13(2): 97-110.
- Jiménez, J.E. & Jaksic, F.M. (1991). Behavioral ecology of Red-backed Hawks in central Chile. *Wilson Bull.* 103(1): 132-137.
- Jiménez, J.E. & Jaksic, F.M. (1993). Observations on the comparative behavioral ecology of Harris' Hawk in central Chile. *J. Raptor Res.* 27(3): 142-148.
- Joensen, A.H. (1967). Urfuglen i Danmark. *Danske Vilddressøgelser* 14: 1-102.
- Johnsen, H. (1961). Die Vogelfauna Westsibiriens—Odis bis Gallus. *J. Orn.* 102: 237-69.
- Johns, A.D. (1986). Effects of selective logging on the ecological organization of a Peninsular Malaysian rainforest avifauna. *Forktail* 1: 65-79.
- Johns, A.D. (1989). Recovery of a Peninsular Malaysian rainforest following selective timber logging: the first twelve years. *Forktail* 4: 89-105.
- Johnsen, R., Espmark, Y., Pedersen, H.C. & Steen, J.B. (1991). Characteristics of territorial and mating calls in Willow Ptarmigan *Lagopus lagopus lagopus*. *Bioacoustics* 3: 17-32.
- Johnsgard, P.A. (1973). *Grouse and Quails of North America*. University of Nebraska Press, Lincoln, Nebraska.
- Johnsgard, P.A. (1975). *North American Game Birds of Upland and Shoreline*. University of Nebraska Press, Lincoln & London.
- Johnsgard, P.A. (1979). The American wood quails. *J. World Pheasant Assoc.* 4: 93-99.
- Johnsgard, P.A. (1982). Etho-ecological aspects of hybridization in the Tetraonidae. *J. World Pheasant Assoc.* 7: 42-57.
- Johnsgard, P.A. (1983a). *The Grouse of the World*. University of Nebraska Press, Lincoln & London.
- Johnsgard, P.A. (1983b). Hybridization and zoogeographic patterns in pheasants. *J. World Pheasant Assoc.* 8: 89-98.
- Johnsgard, P.A. (1985). Grouse. Pp. 257-259 in: Campbell & Lack (1985).
- Johnsgard, P.A. (1986a). The monographic literature of the Galliformes. *J. World Pheasant Assoc.* 11: 21-28.
- Johnsgard, P.A. (1986b). *The Pheasants of the World*. Oxford University Press, London.
- Johnsgard, P.A. (1988). *The Quails, Partridges and Francolins of the World*. Oxford University Press, London.
- Johnsgard, P.A. (1990). *Hawks, Eagles & Falcons of North America. Biology and Natural History*. Smithsonian Institution Press, Washington & London.
- Johnsgard, P.A. & Wood, R.W. (1968). Distributional changes and interactions between Prairie chickens and Sharp-tailed Grouse in the Midwest. *Wilson Bull.* 80: 173-188.
- Johnsingh, A.J.T. & Murali, S. (1980). The ecology and behaviour of the Indian Peafowl *Pavo cristatus* Linn. of Injar. *J. Bombay Nat. Hist. Soc.* 75: 1069-1075.
- Johnson, A.H. (1993). Determining the parameters for viable cracid populations in Amazonian Ecuador. *Cracid News* 2(1): 10.
- Johnson, A.W. (1965). *The Birds of Chile and Adjacent Regions of Argentina, Bolivia and Peru*. Vol. 1. Platt Establecimientos Gráficos, Buenos Aires.
- Johnson, A.W. (1967). *The Birds of Chile and Adjacent Regions of Argentina, Bolivia and Peru*. Vol. 2. Platt Establecimientos Gráficos, Buenos Aires.
- Johnson, A.W. (1972). *Supplement to the Birds of Chile and Adjacent Regions of Argentina, Bolivia and Peru*. Platt Establecimientos Gráficos, Buenos Aires.
- Johnson, B.A. (1963). Habitat preference and behaviour of breeding Junglefowl in central western Thailand. *Wilson Bull.* 75: 270-272.
- Johnson, D. & Guthery, F.S. (1988). Loafing coverts used by Northern Bobwhites in subtropical environments. *J. Wildl. Manage.* 52: 464-469.
- Johnson, F.E.B. (1964). Sonnerai's Junglefowl (*Gallus sonnerai* Temminck). Page 18 in: 1964 *Ornamental Pheasant Trust Report*.

- Johnson, L.L., & Boyce, M.S. (1990). Female choice of males with low parasite loads in Sage Grouse *Centrocercus urophasianus*. In: Loe, J.E., Roper, C.V., & Zuk, M. eds. (1990). *Ecology, Behaviour and Evolution of Intra-specific Interactions*. Oxford University Press, Oxford.
- Johnson, N.K., & Peeters, H.J. (1963). The systematic position of certain hawks in the genus *Buteo*. *Auk* 80: 475-480.
- Johnson, R.E., & Lockner, J.R. (1968). Heart size and altitude in ptarmigan. *Condor* 70: 185.
- Johnson, S.J. (1973). Post-fledging activity of the Red-tailed Hawk. *J. Raptor Res.* 7: 43-48.
- Johnson, S.J. (1986). Development of hunting and self-sufficiency in juvenile Red-tailed Hawks (*Buteo jamaicensis*). *J. Raptor Res.* 20: 29-34.
- Johnson, T.B., & Hilly, S.L. (1976). Notes on the Sickle-winged Guan in Colombia. *Auk* 93: 194-195.
- Johnston, D. (1983). Nesting of the Square-tailed Kite in the Baradine area. *Austr. Birds* 17: 35-37.
- Johnstone, G.W. (1969). *Ecology, Dispersion and Arena Behaviour of Black Grouse Lyrurus tetrix (L.) in Glen Dye, NE Scotland*. PhD thesis, University of Aberdeen, Scotland.
- Jollie, M. (1947). Plumage changes in the Golden Eagle. *Auk* 64: 549-576.
- Jollie, M. (1957). Notes on the bird genus *Aquila* and its occurrence in New Guinea and Australia. *Nova Guinea* 8: 179-181.
- Jollie, M. (1977). A contribution to the morphology and phylogeny of the Falconiformes. *Evolutionary Theory* 1: 285-298; 2: 1-93; 3: 1-91; 4: 1-142.
- Jones, R.J. (1966). Adverse weather affects Merriam's Turkey reproduction in Montana. *J. Wildl. Manage.* 32(4): 987-989.
- Joncour, G. (1986). *L'Épervier d'Europe, Étude d'une Population en Basse Bretagne*. F.I.R., La Garenne-Colombes, France.
- Jones, C.G. (1981). The Mauritius Kestrel. Its biology and conservation. *Hawk Trust Ann. Rep.* 10(1980): 18-29.
- Jones, C.G. (1984a). The captive management and biology of the Mauritius Kestrel *Falco punctatus*. *Int. Zool. Yb.* 23: 76-82.
- Jones, C.G. (1984b). Feeding ecology of the Mauritius Kestrel. Pp. 209 in: Mendelsohn, J.M., & Sapsford, C.W. eds. (1984). *Proceedings of the 2nd Symposium on African Predatory Birds*. Natal Bird Club, Durban.
- Jones, C.G. (1987). The larger land birds of Mauritius. Pp. 208-300 in: Diamond (1987).
- Jones, C.G. (1989). Aerial display of the Reunion Harrier. *Gabiar* 4: 22-23.
- Jones, C.G. (1991). The conservation management of the Mauritius Kestrel *Falco punctatus*. *Gabiar* 6: 42-46.
- Jones, C.G., Heck, W., Lewis, R.E., Munro, J., & Cade, T.J. (1991). A summary of the conservation management of the Mauritius Kestrel *Falco punctatus* 1973-1991. *Dodo* 27: 81-99.
- Jones, D.N. (1979). Notes on the breeding habits of the Brush-turkey. *Sunbird* 10: 10-12.
- Jones, D.N. (1985). Mating system of the Australian Brush-turkey. In: *RAOU Cong. Toowoomba*, Queensland.
- Jones, D.N. (1987a). Animals using the incubation mounds of the Australian Brush-turkey. *Sunbird* 17: 32-35.
- Jones, D.N. (1987b). *Behavioural Ecology of Reproduction in the Australian Brush-turkey Alectura lathami*. PhD thesis, Griffith University, Nathan, Queensland.
- Jones, D.N. (1988a). Selection of incubation mound sites by the Australian Brush-turkey *Alectura lathami*. *Ibis* 130: 251-260.
- Jones, D.N. (1988b). Construction and maintenance of the incubation mounds of the Australian Brush-turkey *Alectura lathami*. *Emu* 88: 210-218.
- Jones, D.N. (1988c). Hatching success of the Australian Brush-turkey *Alectura lathami* in south-east Queensland. *Emu* 88: 260-262.
- Jones, D.N. (1989a). Modern megapode research. A post-Frith review. *Curella* 13(5): 145-154.
- Jones, D.N. (1989b). Mounds and mates - the breeding strategies of the Australian Brush-turkey. *Austr. Sci. Mag.* 31(2): 13-16.
- Jones, D.N. (1990a). Social organization and sexual interactions in Australian Brush-turkeys (*Alectura lathami*): implications of promiscuity in a mound-building megapode. *Ethology* 84: 89-104.
- Jones, D.N. (1990b). Male mating tactics in a promiscuous megapode: patterns of incubation mound ownership. *Behav. Ecol.* 1: 107-115.
- Jones, D.N., & Birks, S. (1992). Megapodes: recent ideas on origins, adaptations and reproduction. *Trends in Ecol. & Evol.* (Tree) 7(3): 88-91.
- Jones, D.N., & Everding, S.E. (1991). Australian Brush-turkeys in a suburban environment: implications for conflict and conservation. *Austr. Wildl. Res.* 18: 285-297.
- Jones, L.L. (1992). Sexual selection and the evolution of extravagant traits in birds: Problems with testing good-genes models of sexual selection. *Auk* 109: 197-199.
- Jones, J. (1963a). Malleefowl mound count. *Bird Observer* 374: 3-4.
- Jones, J. (1963b). Malleefowl mound count. *Bird Observer* 375: 5-7.
- Jones, J.M.B. (1985). The breeding cycle of the African Cuckoo Hawk. *Honeyguide* 31: 196-202.
- Jones, M.A. (1979). A new locality and breeding record for the Blue Quail *Coturnix coturnix*. *Honeyguide* 97: 25.
- Jones, R. (1963). Identification and analysis of Lesser and Greater Prairie Chickens habitat. *J. Wildl. Manage.* 27: 757-758.
- Jones, R. (1964). The specific distinctness of the Greater and Lesser Prairie Chickens. *Auk* 81: 65-73.
- Jones, R. (1966). Spring, summer and fall foods of the Columbian Sharp-tailed Grouse in eastern Washington. *Condor* 68: 536-540.
- Jones, R. (1969). Hormonal control of incubation patch development in the California Quail, *Lophortyx californicus*. *Gen. Comp. Endocrin.* 13: 1-14.
- Jones, S. (1979). *Habitat Management Series for Unique or Endangered Species*. Report No. 17. The accipiters: Goshawk, Cooper's Hawk, Sharp-shinned Hawk. U.S. Department Interior, Bur. Land Management Tech. Note 335.
- Jonkel, C.J., & Greer, K.R. (1963). Fall food habits of Spruce Grouse in northwest Montana. *J. Wildl. Manage.* 27: 593-596.
- Jönsson, K.I., Angelstam, P.K., & Swenson, J.E. (1991). Patterns of life-history and habitat in Palearctic and Nearctic forest grouse. *Ornis Scand.* 22: 275-281.
- Jönsson, P.E. (1992). Häckfågelfaunan i fem fågelskyddsområden i sydvästra Skåne, 1988-1992. *Anser* 31(4): 251-262.
- Jordano, P. (1981). Relaciones interespecificas y coexistencia entre el Aguila Real (*Aquila chrysaetos*) y el Aguila Perdizera (*Hieraaetus fasciatus*) en Sierra Morena Central. *Ardeola* 28: 67-88.
- Jørgensen, E., & Blüx, A.S. (1985). Effects of climate and nutrition on growth and survival of Willow Ptarmigan chicks. *Ornis Scand.* 16: 99-107.
- Jørgensen, E., Bonholt, P., Bogelund, S., & Jensen, P.E. (1982). The breeding population of the Marsh Harrier (*Circus aeruginosus*) in Denmark 1979-1981. *Dan. Orn. Foren. Tidsskr.* 76(1-2): 3-14.
- Jørgensen, J.F. (1977). *Pinnated Grouse (Tympanuchus cupido pinnatus) Movements and Habitat Utilization in the Northern Great Plains*. MSc thesis, University of North Dakota, Grand Forks.
- de Juana, E. (1989). Situación actual de las rapaces diurnas (orden Falconiformes) en España. *Ecología* 3: 237-292.
- Judakov, A.G. (1972). [Biology of the Sharp-winged Grouse in the Amur region]. *Zoologicheskii Zhurnal* 51: 620-622. In Russian.
- del Junco, O. (1984). Estudio sobre una población de Águilas perdiceras (*Hieraaetus fasciatus*). Pp. 80-85 in: CRPR (1984). *Rapinaces Mediterráneas II*. Centre de Recerca i Protecció de Rapinaces, Barcelona, Spain.
- Junge, G.C., & Mees, G.E. (1958). *Die Vögelwelt von Trinidad und Tobago*. E.J. Brill (Zool. Verhand. 37). Leiden.
- Jurlov, K.T. (1960). [Data on the ecology of the Willow Grouse and the Black Grouse in the steppes of Baraba and Kulunda]. *Trudy Biol. Inst. Sib. Otd. Akad. Nauk SSSR (Novosibirsk)* 6: 3-85. In Russian.
- Kabat, C., & Thompson, D.R. (1963). Wisconsin Quail, 1834-1962: population dynamics and habitat management. *Wisconsin Cons. Dept. Tech. Bull.* 30.
- Kalabér, L. (1984). Note sulla biologia e lo sviluppo postembrionale dell'Astore, *Accipiter gentilis*, in Romania. *Riv. Ital. Orn.* 54(3-4): 179-190.
- Kalabér, L. (1993). [Contributions à la connaissance de la biologie de la reproduction et du développement post-embryonnaire des petits du "Aigle pomarin (*Aquila pomarina*)"]. *Studi si comunicari* (1974): 95-118. In Romanian with French summary.
- Kalla, P., & Alsop, F. (1983). The distribution, habitat preference, and status of the Mississippi Kite in Tennessee. *Amer. Birds* 37: 146-149.
- Kalsi, R.S. (1993). Habitat selection of Red Junglefowl at Kalesar Reserve Forest, Haryana, India. Pp. 80-82 in: Jenkins (1993).
- Kalyakin, V.N., & Vinogradov, V.G. (1981). On the nesting of the Gyr Falcon (*Falco rusticolus intermedius* Gloger, 1834) in the southern part of the Yamal Peninsula. *Bull. MOP (Biol.)* 86: 42-51.
- Kampp, K., & Wille, F. (1990). [The White-tailed Eagle population in Greenland]. *Dan. Orn. Foren. Tidsskr.* 84(1-2): 37-44. In Danish with English summary.
- Kane, K.W.S. (1993). The altitude at which Quail *Coturnix coturnix* migrate. *Ibis* 135(4): 469.
- Kang, K. (1969). A note on Rickett's Hill Partridge, *Arborophila gingica* (Gmelin) in Taiwan. *Quart. J. Taiwan Mus.* 22: 121-3.
- Karman, J., & Kacmar, J. (1968). A study of the Secretary Bird, *Bucconia*. 50. *Avian*
- Karr, J.P. (1971). Ecological, behavioral, and distributional notes on some central Panama birds. *Condor* 73: 107-111.
- Kaslova, L. (1986). *Food Selection in Capercaillie and Black Grouse Chicks in South-east Norway*. MSc thesis, Oslo University, Oslo.
- Kastdalen, L., & Wegge, P. (1985). Animal food in Capercaillie and Black Grouse chicks in South East Norway. Pp. 499-509 in: Lovel & Hudson (1985).
- Kastdalen, L., & Wegge, P. (1988). Why and when do Capercaillie chicks die? - preliminary results based on radio-monitored broods in South East Norway. Pp. 65-72 in: Lovel & Hudson (1988).
- Katti, M., Singh, P., Manjekar, N., Sharma, D., & Mukherjee, S. (1992). An ornithological survey in eastern Arunachal Pradesh, India. *Forkuij* 7: 75-90.
- Kaul, R. (1989). *Ecology of the Cheer Pheasant Catreus wallichi in Kashmir Himalaya*. PhD thesis, University of Kashmir, India.
- Kaul, R. (1990a). Functions of winter flocking in the Cheer Pheasant. Pp. 183-185 in: Hill *et al.* (1990).
- Kaul, R. (1990b). Invertebrate abundance, monsoon commencement and hatching-time in the Cheer Pheasant. Pp. 218 in: Hill *et al.* (1990).
- Kaul, R. (1990c). Identification of plants in the diet of adult Cheer Pheasants. Page 220 in: Hill *et al.* (1990).
- Kaul, R. (1992). Indian Mountain Quail. *World Pheasant Assoc. News* 38: 18-19.
- Kaul, R. (1993). Habitat utilisation by Cheer Pheasant. In: Jenkins (1993).
- Kaul, R., & Ahmed, A. (1993). Pheasant surveys in Arunachal Pradesh, India, in February-March 1991. Pp. 50-54 in: Jenkins (1993).
- Kaul, R., & Howman, K. (1991). Quail and francolin studies in western India. *World Pheasant Assoc. News* 32: 19-22.
- Kaul, R., & Howman, S. (1990). Painted Francolin. *World Pheasant Assoc. News* 29: 4-5.
- Kaul, R., & Howman, S. (1992). Distribution and habitat requirements of the Northern Painted Francolin (*Francolinus pinnatus pallidus*) in Jammu, India. Pp. 483-492 in: Birkan, Potts *et al.* (1992).
- Kaul, R., & Kalsi, R. (1990). Swamp Partridge - a pilot survey. *World Pheasant Assoc. News* 30: 3-5.
- Kaul, R., & Qadri, S. (1989). Western Tragopan surveys in the Limber Valley, Kashmir, India. *World Pheasant Assoc. News* 26: 12-14.
- Kavanagh, B. (1992). Irish Grey Partridge *Perdix perdix* population survey 1991, with special reference to population and habitat use in cutaway bogland. Pp. 503-514 in: Birkan, Potts *et al.* (1992).
- Kaveney, M. (1958). Notes on the Brush-turkey. *Emu* 58: 152-153.
- Kelso, A., & Morton, L.S. eds. (1980). *Migrant Birds in the Neotropics: Ecology, Behavior, Distribution and Conservation*. Smithsonian Institution Press, Washington, D.C.
- Keith, L.B. (1963). *Wildlife's Ten-year Cycle*. University of Wisconsin Press, Madison, Wisconsin.
- Keller, H., Pauli, H.R., & Glutz von Blotzheim, U. (1979). Zur Winterernährung des Birkhühners (*Tetrao tetrix*) im subalpinen Fichtenwald der Nördalpenzone. *Orn. Beob.* 76: 9-32.
- Kelly, G.M., & Thorpe, J.P. (1993). A communal roost of Peregrine Falcons and other raptors. *British Birds* 86: 49-52.
- Kelso, L.H. (1937). *Food of the Scaled Quail*. US Department of Agriculture Biological Survey Wildlife Leaflet 84.
- Kemp, A.C. (1972). The use of man-made structures for nesting sites by Lanner Falcons. *Ostrich* 43: 65-66.
- Kemp, A.C. (1975). The development of a Lanner Falcon chick, *Falco biarmicus* Temminck (Aves: Falconidae). *Ann. Transvaal Mus.* 29: 191-196.
- Kemp, A.C. (1978). Territory maintenance and use by breeding Greater Kestrels. Pp. 71-76 in: Kemp, A.C. ed. (1978). *Proceedings of a Symposium on African Predatory Birds*. Northern Transvaal Ornithological Society, Pretoria.
- Kemp, A.C. (1984). Preliminary description of the dynamics of a Greater Kestrel population. Pp. 141-150 in: Mendelsohn, J.M., & Sapsford, C.W. eds. (1984). *Proceedings of the 2nd Symposium on African Predatory Birds*. Natal Bird Club, Durban.
- Kemp, A.C. (1985). Secretary-bird. Page 527 in: Campbell & Lack (1985).
- Kemp, A.C. (1986). The Gabar Goshawk: taxonomy, ecology and further research. *Gabiar* 1: 4-6.
- Kemp, A.C. (1988). Flight and nest display by Gabar Goshawk. *Gabiar* 3: 53.
- Kemp, A.C. (1991). Timing of laying by Greater Kestrels *Falco rupicoloides* near Pretoria, South Africa. *Ostrich* 62: 35-39.
- Kemp, A.C. (1993). Breeding biology of Lanner Falcons near Pretoria, South Africa. *Ostrich* 64: 26-31.
- Kemp, A.C., & Crowe, T.M. (1990). A preliminary phylogenetic and biogeographic analysis of the genera of diurnal raptors. Pp. 161-175 in: Peters, G., & Hutterer, R. eds. (1990). *Vertebrates in the Tropics*. Mus. Alexander Koenig, Bonn, Germany.
- Kemp, A.C., & Crowe, T.M. (1991). Morphometrics of the Falconiformes: an overview. In: *Proc. XX Int. Orn. Congr., Christchurch, 1990*. Vol. 1. Symposium 4.
- Kemp, A.C., & Crowe, T.M. (1993). A morphometric analysis of *Falco* species. Pp. 223-232 in: Nicholls & Clarke (1993).
- Kemp, A.C., & Crowe, T.M. (1994a). A morphometric analysis of *Accipiter* species. In: *Meyburg & Chatterjee* (1994a).
- Kemp, A.C., & Crowe, T.M. (1994b). Morphometrics of falconets and hunting behaviour of the Black-thighed Falconet *Micronia fringillaria*. *Ibis* 136(1): 44-49.
- Kemp, A.C., & Dean, W.R.J. (1988). Diet of African Marsh Harrier from pellets. *Gabiar* 3: 54-55.
- Kemp, A.C., & Filmer, M. (1989). The diet of Greater Kestrels *Falco rupicoloides* near Pretoria, South Africa. *Ostrich* 60: 65-68.
- Kemp, A.C., & Kemp, M.J. (1974). Don't forget the big birds. *Afr. Wildl.* 28: 12-13.
- Kemp, A.C., & Kemp, M.J. (1975a). Observations on the breeding biology of the Ovambo Sparrowhawk, *Accipiter ovampensis* Gurney (Aves: Accipitridae). *Ann. Transvaal Mus.* 29: 185-190.
- Kemp, A.C., & Kemp, M.J. (1975b). Observations on the White-backed vulture *Gyps africanus* in the Kruger National Park, with notes on other avian scavengers. *Noctua* 18: 51-68.
- Kemp, A.C., & Kemp, M.J. (1975c). Random notes on some Sarawak birds. *Sarawak Mus. J.* 24: 273-276.
- Kemp, A.C., & Kemp, M.J. (1976). Nesting cycle of the Gabar Goshawk. *Ostrich* 47: 127-129.
- Kemp, A.C., & Mendelsohn, J. (1975). What colour is Wahlberg's Eagle? *Bokmiskene* 27: 72-74.
- Kemp, A.C., & Rautenbach, L.L. (1989). But Hawks or Bat-eating Hawks? *Gabiar* 2: 4-6.
- Kemp, A.C., & Snelling, J.C. (1973). Ecology of the Gabar Goshawk in southern Africa. *Ostrich* 44: 154-162.
- Kemp, M.J., & Kemp, A.C. (1978). *Bucconis and Sagittarius*, two modes of terrestrial predation. Pp. 13-16 in: Kemp, A.C. ed. (1978). *Proceedings of a Symposium on African Predatory Birds*. Northern Transvaal Ornithological Society, Pretoria.
- Kennerly, J.E. (1988). Pen-raised turkeys, a threat to wild populations. *Turkey Call* 15(5): 22-23.
- Kennerly, J.E., & Arner, D.H. (1967). Winter food available to the Wild Turkey in a hardwood forest. *Proc. Ann. Conf. Southeast. Assoc. Game & Fish Comm.* 21: 123-129.
- Kennerly, J.E., & Kennerly, M.C. eds. (1985). *Proceedings of the Fifth National Wild Turkey Symposium*. National Wild Turkey Federation, Edgefield, South Carolina, USA.
- Kennedy, P.L. (1987). Habitat Characteristics of Cooper's Hawks and Northern Goshawks nesting in New Mexico. Pp. 78-87 in: *Southwest Raptor Management: One year and Working*.
- Kennedy, P.L., & Johnson, D.R. (1986). Prey size selection in nesting male and female Cooper's Hawks. *American Bird* 98: 110-115.
- Kennedy, R.S. (1957). Notes on the biology and population status of the Monks-eating Eagle of the Philippines. *Wilson Bull.* 89: 1-20.
- Kennedy, R.S. (1981). The air's noblest flier. *Fil. J. Sci. & Cult.* 2: 33-48.
- Kennedy, R.S. (1983). Can Filipinos learn to love this bird? *Int. Wildl.* 13(4): 26-33.
- Kennedy, R.S. (1985). Conservation research of the Philippine Eagle. *Natl. Geogr. Soc. Res. Rep.* 18: 401-414.
- Kennedy, R.S. (1977). Predation on released Pheasants (*Phasianus versicolor*) by Goshawks (*Accipiter gentilis*). *Wildfowl* 10: 79-112.
- Kennedy, R.S. (1978). Hawks and doves: factors affecting success and selection in Goshawks attacking Woodcock. *J. Anim. Ecol.* 47: 449-460.
- Kennedy, R.S. (1981). Goshawk resuscitation in human causes and implications. *J. Anim. Ecol.* 7(5): 531-540.
- Kennedy, R.S. (1982). Goshawk hunting behaviour and range size as a function of food and habitat availability. *J. Anim. Ecol.* 51(1): 69-80.
- Kennedy, R.S., & Linzey, V. (1981). *Understanding our Goshawk*. International Association for Falconry, London, England.
- Kennedy, R.S., Marström, V., & Karlhom, M. (1981). Goshawk winter ecology in Sweden: place of habitats. *J. Wildl. Manage.* 45: 397-408.
- Kennedy, R.S., Marström, V., & Karlhom, M. (1993). Personality, behaviour, and ecology of Goshawks (*Accipiter gentilis*). I. The causes of dispersal. II. Sex differences in sociality and nest-switching. *Anim. Behav.* 46: 365-370.
- Kennedy, R.S., & G. (1993). The size of the Goshawk (*Accipiter gentilis*) territory in Sweden. *Condor* 97: 91-92.

- Keppie, D.M. (1975b). *Dispersal, Overwinter Mortality and Population Size of Spruce Grouse* (Canachites canadensis Franklin) PhD dissertation, University of Alberta, Edmonton, Canada.
- Keppie, D.M. (1977a). Inter-brood movements of juvenile Spruce Grouse. *Wilson Bull.* 89: 67-72.
- Keppie, D.M. (1977b). Snow cover and the use of trees by Spruce Grouse in autumn. *Condor* 79: 382-384.
- Keppie, D.M. (1979). Dispersal, overwinter mortality and recruitment of Spruce Grouse. *J. Wildl. Manage.* 43: 717-727.
- Keppie, D.M. (1982). A difference in production and associated events in two races of Spruce Grouse. *Can. J. Zool.* 60: 2116-2123.
- Keppie, D.M. (1987a). Impact of demographic parameters upon a population of Spruce Grouse in New Brunswick. *J. Wildl. Manage.* 51: 771-777.
- Keppie, D.M. (1987b). Do some female Spruce Grouse not breed? *Can. J. Zool.* 65: 211-213.
- Keppie, D.M. (1991). The termination of spring display by male Spruce Grouse and commencement of egg laying by female. *Can. J. Zool.* 69: 3000-3004.
- Keppie, D.M., & Herzog, P.W. (1978). Nest site characteristics and nest success of Spruce Grouse. *J. Wildl. Manage.* 42: 628-632.
- Keppie, D.M., & Towers, J. (1990). Using phenology to predict commencement of nesting of female Spruce Grouse (*Dendragapus canadensis*). *Amer. Midl. Naturalist* 124: 164-170.
- Keran, D. (1978). Nest site selection by the Broad-winged Hawk in north central Minnesota and Wisconsin. *J. Raptor Res.* 12: 15-20.
- Kerlinger, P. (1989). *Flight Strategies of Migrating Hawks*. The University of Chicago Press, Chicago.
- Kermott, L.H. (1982). *Breeding Behavior in the Sharp-tailed Grouse*. PhD thesis, University of Minnesota, St. Paul.
- Kermott, L.H. & Oring, L.W. (1975). Acoustical communication of male Sharp-tailed Grouse (*Pedioecetes phasianellus*) on a North Dakota dancing ground. *Anim. Behav.* 23: 315-386.
- Kerr, J.G. (1950). *A Naturalist in the Gran Chaco*. Cambridge University Press.
- Keve, A., & Szilji, J. (1957). Distribution, biologie et alimentation due Faucon Kobez *Falco vespertinus* L. en Hongrie. *Alauda* 25: 1-22.
- Keymer, J.F., Fletcher, M.R., & Stanley, P.I. (1981). Cause of mortality in British Kestrels (*Falco tinnunculus*). pp. 143-151 in: Cooper, J.E. & Greenwood, A.G. eds. (1981). *Recent Advances in the Study of Raptor Diseases*. Chiron Publications, Keighley.
- Keys, M.G. (1990). Relocation of Australian Brush-turkeys. *Sinbird* 20: 33-36.
- Khachar, S., & Mundkur, T. (1989). Status and distribution of the King Vulture *Saragyps calvus* (Scopoli) in Gujarat: Results of a recent enquiry. *J. Bombay Nat. Hist Soc.* 86: 360-362.
- Khan, W.M., & Shah, I.I. (1987). Population dynamics of the Koklas Pheasant *Pucrasia macrolopha* in Malkandi Forests, Pakistan. pp. 40-51 in: Savage & Ridley (1987).
- Kharchenko, V.I., & Minoransky, V.A. (1967). [On contemporary distribution of the Steppe Eagle (*Aquila rapax* Temm.) in the European part of the USSR]. *Zoologicheskii Zhurnal* 46: 958-960. In Russian.
- Kiel, W.H. (1976). Bobwhite Quail population characteristics and management implications in south Texas. *Trans. North Amer. Wildl. Nat. Resour. Conf.* 41: 407-420.
- Kiff, L.F. (1983). An historical perspective on the condor. *Outdoor California* 44: 5-6, 34-37.
- Kiff, L.F. (1988). Eggs of the Orange-breasted Falcon (*Falco deimileucus*). *J. Raptor Res.* 22(4): 116-117.
- Kiff, L.F. (1990). To the brink and back: the battle to save the California Condor. *Terra* 28: 6-18.
- Kiff, L.F., Peakall, D.B., & Hector, D.P. (1980). Eggshell thinning and organochlorine residues in the Bat and Aplomado Falcons in Mexico. pp. 949-952 in: *Proc. XVII Int. Orn. Congr., Berlin*, 1978.
- Kiff, L.F., Wallace, M.P., & Gale, N.B. (1989). Eggs of captive Crested Eagles (*Morphnus guianensis*). *J. Raptor Res.* 23(3): 107-108.
- Kilbride, K.M., Crawford, J.A., Blakely, K.L., & Williams, B.A. (1992). Habitat use by breeding female California Quail in western Oregon. *J. Wildl. Manage.* 56: 85-90.
- Kilham, L. (1980). Pre-nesting behavior of the Swallow-tailed Kite (*Elanoides forficatus*), including interference by an unmated male with a breeding pair. *J. Raptor Res.* 14(1): 29-31.
- Kilpatrick, H.J., Husband, T.P., & Pringle, C.A. (1988). Winter roost site characteristics of Eastern Wild Turkeys. *J. Wildl. Manage.* 52(3): 461-463.
- Kilpatrick, H.J., Litvaitis, J.A., & Thomas, G.E. (1990). Seasonal Roost-site Characteristics of Turkeys in South-eastern New Hampshire. *Trans. Northeast Sect. Wildl. Soc.* 47: 10-14.
- Killie, R.A. (1987). Winter abundances of Red-tailed and Red-shouldered Hawks in Florida: an analysis of Christmas Bird count data, 1946-1983. *Florida Field Nat.* 15: 45-51.
- Kinball, J.W. (1949). The crowing count Pheasant census. *J. Wildl. Manage.* 13: 101-120.
- Kimber, R.G. (1985). The history of Mallard in central Australia. *RAOU Newsl.* 64: 6-8.
- Kimberly, T., & Mosher, J.A. (1981). Nest-site habitat selected by Woodland Hawks in Central Appalachians. *Auk* 98: 270-281.
- Kimmel, V.L. & Fredrickson, L.H. (1981). Nesting ecology of the Red-shouldered Hawk in southeastern Missouri. *Trans. Missouri Acad. Sci.* 15: 21-27.
- King, B.F. (1987). Wild sightings of Cabot's Tragopan. *World Pheasant Assoc. News* 18: 21-23.
- King, B.F. (1989a). Birds observed at Huang Nian Shan, Mabian county, southern Sichuan, China. *Forktail* 4: 63-68.
- King, B.F. (1989b). Birds observed at Dalending Panda Reserve, Mabian county, southern Sichuan, China. *Forktail* 4: 63-68.
- King, B.F. (1990). Little Eagle *Hieraeetus morphnoides*. *Kukila* 5(1): 77.
- King, B.F. (1992). Reeves' Pheasant in close encounter. *World Pheasant Assoc. News* 37: 12-16.
- King, B.F. & Peng Ji-tai (1991). Some bird observations in Ganzi prefecture of extreme north-west Sichuan, China. *Forktail* 6: 15-23.
- King, B.F., Buck, H., & Yung, D. (1990). Grey-headed Fish-eagle *Icthyophaga ichthyaeus*. *Kukila* 5(1): 75.
- King, B.F., Woodcock, M., & Dickinson, E.C. (1975). *A Field Guide to the Birds of South-east Asia*. Collins, London.
- King, D.G. (1971). *The Ecology and Population Dynamics of Blue Grouse in the Sub-alpine*. MSc thesis, University of British Columbia, Vancouver, Canada.
- King, D.G. (1973). Feeding habits of Blue Grouse in the subalpine. *Sylvia* 6: 121-125.
- King, D.G., & Bendall, J.F. (1982). Foods selected by Blue Grouse (*Dendragapus obscurus fuliginosus*). *Can. J. Zool.* 60: 3268-3281.
- King, J.R. (1989). Notes on the birds of the Rio Marañ Valley, Azuay Province, Ecuador, with special reference to *Leptostyria brancifl.*, *Haplophysa amazonia pyrrhops* and *Metallura baroni*. *Bull. Brit. Orn. Club* 109(3): 140-147.
- King, W.R. ed. (1978/79). *Endangered Birds of the World: the ICBP Bird Red Data Book*, Vol. 2, Aves. 2nd. edition. IUCN, Morges, Switzerland.
- Kirikov, S.V. ed. (1975). *Interetivnye pticy* [Grouse]. Moscow, In Russian.
- Kirikov, S.V., & Schubnikov, O.N. eds. (1968). *Resursy terevinykh ptits SSSR* [Grouse resources in the USSR]. Moscow, In Russian.
- Kirby, D. (1988). *The Ecology of Small Cathartid Vultures*. PhD thesis, Glasgow University.
- Kirkconnell, A., & Garrido, O. (1991). The Osprey nesting in Cuba. *Volante Migratorio* 16: 28-29.
- Kirkley, J.S. (1991). Do migrant Swainson's Hawks *fasti en route* to Argentina? *J. Raptor Res.* 25: 82-86.
- Kirkwood, J.K. (1980). Energy and prey requirements of the young free-flying kestrels. *Hawk Trust Ann. Rep.* 10: 12-14.
- Kirkwood, J.K. (1981a). *Bioenergetics and Growth in the Kestrel* (*Falco tinnunculus*). PhD thesis, University of Toronto. [Download]
- Kirkwood, J.K. (1981b). Energy and nitrogen exchange during growth in the Kestrel (*Falco tinnunculus*). *Proc. Natl. Soc.* 40: 6.
- Kirpichov, N.P. (1972). [The moult of the Capercaillie]. *Ornithologia* 10: 303-319. In Russian.
- Kirsch, L.M. (1974). Habitat management considerations for Prairie Chickens. *Wildl. Soc. Bull.* 2: 124-129.
- Kirsch, L.M., Klett, A.T., & Miller, H.W. (1973). Land use and prairie grouse population relationships in North Dakota. *J. Wildl. Manage.* 37: 449-453.
- Kirven, M.N. (1976). *The Ecology and Behavior of the Bat Falcon*, *Falco rufigularis*. PhD dissertation, University of Colorado, Boulder.
- Kishechinskii, A.A. (1958). On the biology of the Gyrfalcon on the Kola Peninsula. *Proc. Mosk. State Univ.* 197: 190-194.
- Kislenko, G.S. (1983). [Lesser Spotted Eagle in man-made landscape in Kuban]. pp. 48-50 in: [Conservation of Birds of Pres]. Nauka, Moscow. In Russian.
- Kivokku, K. (1976). A study in the biology of the megapodes of West New Britain. *Papua New Guinea Bird Soc. News* 121: 18-20.
- Kliewski, I. (1994). Montagu's Harrier *Circus pygmaeus* post-fledging activities in Eastern Poland - preliminary results. In: Meyburg & Chancellor (1994a).
- Kobayashi, Y. (1985). *Tachycineta thalassina* [Vol. 3]. Kodansha Japan.
- Kozdroja, I. (1993). *The Birds of Turkey (Species List in Red Data Book)*. Türkiye Tabiatını Koruma Derneği (Turkish Association for the Conservation of Nature and Natural Resources) Publication 20.
- Kjaran, B. (1967). [The White-tailed Eagle]. Bokförläggningen H.F., Reykjavik, Iceland. In Icelandic.
- Kjellén, N. (1992). Differential timing of autumn migration between sex and age groups in raptors at Falsterbo, Sweden. *Ornis Scand.* 23: 420-434.
- Kjos, C.G. (1992). Bald Eagle numbers continue to rise. *US Fish Wildl. Serv. Endang. Species Tech. Bull.* 17(1-2): 3-4.
- Klaus, E.E. (1968). Summer birds from the Yucatán Peninsula, Mexico. *Univ. Kansas Publ. Mus. Nat. Hist.* 17: 581-611.
- Klapste, J. (1983). Observations of two species of kites fishing. *Emu* 83: 278-279.
- Klapste, J. (1990). Movement of Brown Falcon *Falco berigora* from Victoria to Tasmania. *Aust. Bird Watcher* 13: 166-167.
- Klapste, J., & Klapste, P. (1982). Successful rearing of young of the Spotted Harrier in an artificial nest. *Corella* 6: 42-43.
- Klau, W. (1985). Spotted Harriers *Circus assimilis* nesting on the Nullarbor Plain. *Aust. Bird Watcher* 11: 46-48.
- Klaus, S. (1991). Effects of forestry on grouse populations: case studies from the Thuringian and Bohemian forests. Central Europe. *Ornis Scand.* 22: 218-224.
- Klaus, S., Andreev, A.V., Bergmann, H.H., Müller, F., Porkert, J., & Wiesner, J. (1989). *Die Birkhühner* Tetrao urrogallus and Tetrao urrogallides. 2nd. edition. Neue Brehm-Bücherei 86. A. Ziemsen Verlag, Wittenberg Lutherstadt.
- Klaus, S., Bergmann, H.H., Marti, C., Müller, F., Vitovic, O.A., & Wiesner, J. (1990). *Die Birkhühner* Tetrao tetrix and Tetrao mikloszewici. 2nd ed. Neue Brehm-Bücherei 397. A. Ziemsen Verlag, Wittenberg Lutherstadt.
- Klaus, S., Boock, W., Görner, M., & Seibt, E. (1988). Zur Ökologie des Auerhuhns (*Tetrao urrogallus* L.) in Thüringen. *Acta ornithoecol. Jena* 1: 3-46.
- Klaus, S., Seibt, E., & Boock, W. (1991). Zur Ökologie des Birkhuhns (*Tetrao tetrix*) im mittleren Thüringer Wald. *Acta ornithoecol. Jena* 2: 211-229.
- Klaus, S., Vogel, F., & Wiesner, J. (1968). Ein Beitrag zum Auerwildproblem im Elbsandsteingebirge. I. Charakteristik eines Balzplatzes. *Zool. Abh. Mus. Tierkde. Dresden* 29: 103-118.
- Klaus, S., Wiesner, J., & Vitovic, O.A. (1988). Revision der Werbeverhalten des Kaukasischen Birkhuhns, *Tetrao mikloszewici* Taczanowski. *Acta ornithoecol. Jena* 1: 307-324.
- Klebenow, D.A. (1968). *Nesting and Brood Habitat of Sage Grouse*. PhD thesis, University of Idaho.
- Klebenow, D.A. (1969). Sage Grouse nesting and brood habitat in Idaho. *J. Wildl. Manage.* 33: 649-662.
- Klebenow, D.A., & Gray, G.M. (1968). Food habits of juvenile Sage Grouse. *J. Wildl. Manage.* 21: 80-83.
- Klein, B.C., & Bierregaard, R.O. (1988a). Capture and telemetry techniques for the Lined Forest-falcon (*Micrastur gyvicolis*). *J. Raptor Res.* 22(1): 29.
- Klein, B.C., & Bierregaard, R.O. (1988b). Movement and calling behavior of the Lined Forest-falcon (*Micrastur gyvicolis*) in the Brazilian Amazon. *Condor* 90(2): 497-499.
- Klein, B.C., Harper, L.H., Bierregaard, R.O., & Powell, G.V.N. (1988). Nesting and feeding behavior of the Ornate Hawk-eagle, *Spizaetus ornatus*. *Condor* 90(1): 239-241.
- Klimatski, J.F., & Moschione, F.N. (1987). *Aves de la Reserva Integral de Selva Marginal de Punta Lara y sus Alrededores*. Dirección de Servicios Generales del Ministerio, Argentina.
- Klimstra, W.D., & Roseberry, J.L. (1975). Nesting ecology of the Bobwhite in southern Illinois. *Wildl. Monogr.* 41: 1-37.
- Kloska, C. (1986). Untersuchungen zur Brutbiologie des Kammtalegalla (*Aegypodius arfakianus* Salvad.). Unpublished report. University of Hamburg.
- Kloska, C., & Nicolai, J. (1988). Fortpflanzungsverhalten des Kammtalegalla (*Aegypodius arfakianus* Salvad.). *J. Orn.* 129: 185-204.
- Klott, J.H., & Lindzey, F.G. (1989). Comparison of Sage and Sharp-tailed Grouse leks in south central Wyoming. *Great Basin Nat.* 49: 275-278.
- Klott, J.H., & Lindzey, F.G. (1990). Brood habitats of sympatric Sage Grouse and Columbian Sharp-tailed Grouse in Wyoming. *J. Wildl. Manage.* 54: 84-88.
- Knight, C.W.R. (1927). *The Book of the Golden Eagle*. Hodder and Stoughton Ltd, London, UK.
- Knight, R.L., & Erickson, A.W. (1976). High incidence of snakes in the diet of nesting Red-tailed Hawks. *J. Raptor Res.* 10: 108-111.
- Knoder, C.E. (1983). Elliot's Pheasant conservation. *J. World Pheasant Assoc.* 8: 11-28.
- Knoder, C.E., & Baile, R.M. (1956). The ecology and breeding biology of the Reeves' Pheasant on Tappan Island, 1955. *Ohio Wildl. Invest.* 7(3): 36-45.
- Knystautas, A. (1993). *Birds of Russia*. Harper Collins Publishers, London.
- Kobayashi, H., & Gurnay, K.J. (1993). A new breeding site of the Maleo in Central Sulawesi. *Kukila* 6: 131.
- Kobriger, G.D. (1965). Status, movements, habitats, and foods of prairie grouse on a sandhills refuge. *J. Wildl. Manage.* 29: 788-800.
- Kobriger, G.D. (1975). Correlation of Sharp-tailed Grouse population parameters. *North Dakota Outdoors* 38: 10-13.
- Kobriger, G.D. (1980). Habitat use and brooding Sharp-tailed Grouse in southwestern North Dakota. *North Dakota Outdoors* 43: 2-5.
- Koch, N. (1978). Hasel und Auerhuhn an der Hohen Rone (Kanton Zug, Schweiz). *Schweizerisch Zeitschrift für Forstwesen* 129: 897-933.
- Kochert, M.N. (1972). *Population Status and Chemical Contamination in Golden Eagles in Southwestern Idaho*. MSc thesis, University of Idaho.
- Kochert, M.N., Millsap, B.A., & Steenhof, K. (1988). Effects of livestock grazing on raptors with emphasis on the southwest. pp. 325-334 in: Pendleton, B.G. ed. (1988). *Proceedings of the Western Raptor Management Symposium and Workshop*. National Wildlife Federation, Washington, D.C.
- de Kock, A.C., & Simmonds, R. (1988). Chlorinated hydrocarbon residues in African Marsh Harrier eggs and concurrent reproductive trends. *Ostrich* 59: 180-181.
- de Kock, A.C., & Watson, R.T. (1985). Organochlorine residue levels in Bateleur eggs from the Transvaal. *Ostrich* 56: 278-280.
- König, C. (1979). Gibt es einen feldornithologisch erkennbaren Sexualdimorphismus beim Wolkopfgeier (*Trigoniceps ocellatus*)? *Vogelwelt* 100: 44-48.
- Koepecke, H.W., & Koepecke, M. (1963). *Las Aves Silvestres de Importancia Económica del Perú*. Ministerio de Agricultura, Servicio Forestal y de Caza y Servicio de Pesquería, Lima.
- Koepecke, M. (1961). Birds of the western slope of the Andes of Peru. *Amer. Mus. Novit.* 2028: 1-31.
- Koepecke, M. (1970). *The Birds of the Department of Lima, Peru*. Livingston Publishing Company, Wynnewood, PA.
- Koepecke, M. (1972). Über die resistenzformen der Vogelhester in einem bergigen Gebiet des tropischen Regenwaldes in Peru. *J. Orn. Leipzig* 113: 138-160.
- Koethr, N.E., & Guthery, F.S. (1991). Water restriction effects on Northern Bobwhite reproduction. *J. Wildl. Manage.* 55: 132-136.
- Koford, C.B. (1953). The Californian Condor. *Natl. Audubon Soc. Res. Rep.* 6.
- Koga, K., & Shiraishi, S. (1987). [Parental care of nesting in the Black-eared Kite *Milvus migrans*]. *Jap. J. Orn.* 36(2/3): 87-97. In Japanese with English summary.
- Koga, K., Shiraishi, S., & Uchida, T.A. (1989a). Breeding ecology of the Black-eared Kite *Milvus migrans lineatus* in the Nagasaki Peninsula, Kyushu. *Jap. J. Orn.* 38: 57-66.
- Koga, K., Shiraishi, S., & Uchida, T.A. (1989b). Growth and development of the Black-eared Kite *Milvus migrans lineatus*. *Jap. J. Orn.* 38(1): 31-42.
- Koga, K., Shiraishi, S., & Uchida, T.A. (1989c). Acquisition of homeothermy in the Black-eared Kite, *Milvus migrans lineatus*. *J. Fac. Agr. Kyushu Univ.* 33: 235-242.
- Kohn, S.C. (1976). *Sharp-tailed Grouse Nesting and Brooding Habitat in Southwestern North Dakota*. MSc thesis, South Dakota State University, Brookings.
- Koivisto, I. (1965). Behaviour of the Black Grouse during the spring display. *Finnish Game Res.* 26: 1-60.
- Koivisto, I., & Pirkola, M. (1961). [Behaviour and numbers of Capercaillie and Black Grouse in display grounds]. *Summen Rytty* 14: 53-64. In Finnish.
- Kojima, Y. (1982). Territory and territorial behaviour of the Grey-faced Buzzard-Eagle *Buteo indicus*. *Tori* 30: 117-147.
- Kojima, Y. (1987). Breeding success of the Grey-faced Buzzard Eagle *Buteo indicus*. *Jap. J. Orn.* 36: 71-78.
- Kotschal, M.T., & Væge, P. (1985). The habitat ecology of Black Grouse (*Tetrao tetrix*) during spring and summer in east Norway. *Medd. Norsk Viltforsk.* 13: 1-46.
- Komen, J. (1986). A comparison of behaviour and vocalization in some African francolins (Phasianidae). In: *Proc. XIX Int. Orn. Congr. Ottawa*, 1986.
- Komen, J. (1987). Preliminary observations of the social pattern, behaviour and vocalization of Hartlaub's Francolin. *S. Afr. J. Wildl. Res.* 16(Suppl.): 82-86.
- Komen, J. (1990). Hartlaub's Francolin research project. *World Pheasant Assoc. News* 28: 18-20.
- Komen, J. (1991a). Energy requirements of nesting Cape Vultures. *Condor* 93: 153-158.
- Komen, J. (1991b). Little known francolins. *World Pheasant Assoc. News* 31: 8-10.

- Lavery, H.J. & Johnson, P.M. (1993). The Black Kite *Mitrus migrans* in the Townsville district of Queensland: a comparison of irruption and non-irruption years. In: Olsen (1993a).
- van Lawick-Goodall, J. (1968). Tool-using bird: the Egyptian Vulture. *Natl. Geogr.* 133: 630-641.
- Lawrence, J.S. (1982). *Effect of Predator Reduction on the Reproductive Success of Attwater's Prairie Chicken*. MSc thesis, Texas A & M University Press, College Station.
- Lawrence, J.S. & Silvy, N.J. (1980). Status of the Attwater's Prairie Chicken - an update. Pp. 29-33 in: Vohs & Knopf (1980).
- Lawrence, J.S. & Silvy, N.J. (1987). Movement and mortality of transplanted Attwater's Prairie Chickens. *J. World Pheasant Assoc.* 12: 57-65.
- Lawrence, S.B. & Gay, C.G. (1991). Behaviour of fledgling New Zealand Falcons (*Falco novaeseelandiae*). *Notornis* 38: 173-182.
- Lawson, B.A. (1982). *Dichromatism of Ruffed Grouse and Associated Meteorological Variables*. MSc thesis, Frostburg State College, Frostburg, Maryland.
- Lawton, J.H. ed. (1990). *Red Grouse Populations and Moorland Management*. British Ecological Society Ecological Issues 2. Field Studies Council, Shrewsbury, UK.
- Lebraud, C. (1984). Observations sur le comportement et le régime alimentaire de l'Aigle de Bonelli (*Hieraetus fasciatus*) pendant la période de nidification. *Bull. Centre Orn. Gard.* 1: 6-14.
- Leclercq, B. (1987). *Écologie et Dynamique des Populations de Grand Tétrins dans le Jura Français*. PhD thesis, Université de Bourgogne, France.
- Leclercq, B. (1988a). *Le Grand Coq de Bruyère*. Ed. Sang de la Terre, Paris.
- Leclercq, B. (1988b). Premières données sur la comparaison de la dynamique des populations de Grand Tétrins *Tetrao urogallus* et de Gélinitte des Bois *Bonasa bonasia* d'un même massif forestier du Haut-Jura. *Gibier Faune Sauvage* 5: 273-288.
- Leconte, M. (1977). *Étude de la reproduction de Gyps fulvus dans les Pyrénées occidentales*. Université de Bordeaux, France.
- Leconte, M. (1985). Present status of the Griffon Vulture on the Northern slopes of Western Pyrenees. Pp. 117-127 in: Newton & Chancellor (1985).
- Ledant, J.P. (1990). La situation de la Gélinitte des bois (*Bonasa bonasia*) en Ardenne et dans les régions voisines. *Avies* 27: 159-172.
- Ledger, J.A. ed. (1984). *Proceedings of the V Pan-African Ornithological Congress*. Southern African Ornithological Society, Johannesburg.
- Ledger, J.A. & Anegarn H.J. (1980). Electrocution hazards to the Cape Vulture *Gyps coprotheres* in South Africa. *Bird. Conserv.* 20: 15-24.
- Lee, R.O. (1966). Through Quintana Roo, 1965. *Expl. J.* 44: 83-88.
- Lees, S.G. (1968). Notes on the nesting of Wahlberg's Eagle *Aquila wahlbergi*. *Ostrich* 39: 192-193.
- LeFebvre, E.A.Z. & LeFebvre, J.J. (1958). Notes on the ecology of *Dactylorhynchus thoracicus*. *Wilson Bull.* 70: 372-377.
- LeFranc, M.N. & Clark, W.S. (1983). *Working Bibliography of the Golden Eagle and the Genus Aquila*. National Wildlife Federation. Scientific & Technical Series 7.
- Lehmann, F.C. (1943). El género *Morphnus*. *Caldasia* 2: 165-179.
- Lehmann, F.C. (1945). Contribuciones al estudio de la fauna de Colombia. *Rev. Universidad del Cauca (Colombia)* 6: 73-124.
- Lehmann, F.C. (1959). Contribuciones al estudio de la fauna de Colombia XIV. Nuevas observaciones sobre *Omaeetus isidori* (Des Murs). *Novedades Colombianas* 1: 169-195.
- Lehmann, F.C. & Haffer, J. (1960). Notas sobre *Buteo albigula* Philippi. *Novedades Colombianas* 1: 242-255.
- Lehmann, V.W. (1941). *Attwater's Prairie Chicken: Its Life History and Management*. North American Fauna 57. Fish and Wildlife Service. United States Department of the Interior.
- Lehmann, V.W. (1953). Bobwhite fluctuations and vitamin A. *Trans. North Amer. Wildl. Nat. Resour. Conf.* 18: 199-246.
- Lehmann, V.W. (1968). The Attwater Prairie Chicken, current status and restoration opportunities. *Trans. North Amer. Wildl. Nat. Resour. Conf.* 33: 398-407.
- Lehmann, V.W. (1984). *Bobwhites in the Rio Grande Plain of Texas*. Texas A & M University Press, College Station.
- Lehmann, V.W. & Ward, H. (1941). Some plants valuable to quail in southwestern Texas. *J. Wildl. Manage.* 5: 131-135.
- Lehtonen, L. (1942). Schelladler (*Aquila clanga* Pallas) als Brutvogel in Kananien, Ost-Karelien. *Ornis Fenn.* 19: 121-122.
- Leighton, F.A., Gerrard, J.M., Gerrard, P., Whitfield, D.W.A. & Maher, W.J. (1979). An aerial census of Bald Eagles in Saskatchewan. *J. Wildl. Manage.* 43: 61-68.
- Lekagul, B. & Cronin, E.W. (1974). *Bird Guide of Thailand*. Association for the Conservation of Wildlife, Bangkok.
- Lekagul, B. & Round, P.D. (1991). *A Guide to the Birds of Thailand*. Saha Burn Bhact, Bangkok.
- Leland, L. & Struhsaker, T.T. (1993). Teamwork tactics. *Nat. Hist.* 4/93: 43-48.
- Lelliott, A.D. (1981). Cheer Pheasants in west-central Nepal. *J. World Pheasant Assoc.* 6: 89-95.
- Lelliott, A.D. (1987). Survey of Cheer Pheasants near Dhorpatan, west Nepal, 1981. Pp. 58-61 in: Savage & Ridley (1987).
- Lelliott, A.D. & Yonzon, P.B. (1980a). Pheasant studies in the Annapurna Himal I: field studies. Pp. 53-55 in: Savage (1980).
- Lelliott, A.D. & Yonzon, P.B. (1980b). Studies of Himalayan pheasants in Nepal. *J. World Pheasant Assoc.* 5: 11-30.
- Lemay, Y. (1989). *Caractérisation de l'Habitat de Reproduction de Tétrins du Canada (Dendragapus canadensis) sur l'île d'Anticosti*. MSc thesis, University of Québec, Trois Rivières.
- Lemke, T.O. (1979). Fruit-eating behavior of Swallow-tailed Kites (*Elanoides forficatus*) in Colombia. *Condor* 81(2): 207-208.
- Lemke, T.O. (1984). Micronesian Megapode surveys and inventories. Pp. 106-110 in: Pittman-Robertson job progress rep. FY 1984. Unpublished report. Division of Fish & Wildlife, Commonwealth of the Northern Mariana Islands.
- Lemon, W.C. (1991). Foraging behavior of a guild of Neotropical vultures. *Wilson Bull.* 103(4): 698-702.
- Lendrum, A.L. (1979). The Augur Buzzard *Buteo rufifasciatus* augur in the Matopos, Rhodesia. *Ostrich* 50: 203-214.
- Lendrum, A.L. (1982). Ayres' Hawk Eagle in Bulawayo, Zimbabwe. *Honeyguide* 110: 15-22.
- Lendrum, A.L. & Lendrum, J.P. (1982). Behaviour studies of Augur Buzzards in the Matopos, Zimbabwe. *Ostrich* 53: 242-243.
- Lennerstedt, I. (1966). Egg temperature and incubation rhythm of a Capercaillie (*Tetrao urogallus* L.) in Swedish Lapland. *Oikos* 17: 169-174.
- León-Vizcaino, L. & Castroviejo, J. (1978). Sobre infecciones estafilocócicas en Águila Imperial (*Aquila adalberti* Brehm). *Doñana Acta Vertebrata* 5: 89-95.
- Leonardi, G. (1994). The home range of the Lanner *Falco biarmicus* Feldegg: influences of territory composition. In: Meyburg & Chancellor (1994a).
- Leonardi, G., Jongo, A. & Corpina, G. (1992). *Ecology and Behaviour of the Lanner Falcon*. G. Leonardi Editore, Catania.
- Leopold, A.S. (1944). The nature of heritable wildness in Turkeys. *Condor* 46(4): 133-197.
- Leopold, A.S. (1948). The Wild Turkeys of Mexico. *North Amer. Wildl. Nat. Resources Conf.* 13: 393-400.
- Leopold, A.S. (1953). Intestinal morphology of gallinaceous birds in relation to food habits. *J. Wildl. Manage.* 17: 197-203.
- Leopold, A.S. (1959). *Wildlife of Mexico: the Game Birds and Mammals*. University of California Press, Berkeley & Los Angeles.
- Leopold, A.S. (1977). *The California Quail*. University of California Press, Berkeley and Los Angeles.
- Leopold, A.S. & McCabe, R.A. (1957). Natural history of the Monezuma Quail in Mexico. *Condor* 59: 3-26.
- Leopold, A.S. & Wolfe, T.O. (1970). Food habits of nesting Wedge-tailed Eagles, *Aquila audax*, in south-eastern Australia. *Cyano Wildl. Rev.* 15: 1-17.
- LeSasser, A.L. & Williams, F.C. (1959). Notes on a late nesting of Harris' Hawks near Midland, Texas. *Wilson Bull.* 71: 386-387.
- Lessem, Y. (1976). *The Biology of the Bonelli's Eagle Hieraetus fasciatus fasciatus in Israel*. MSc thesis, Tel-Aviv University.
- Lessem, Y. (1984). The rapid population decline of Israel's Lappet-faced Vulture *Torgos irachellinus negevensis*. *Ornis Fenn.* 31: 23-37.
- Lesnitsky, V.V., Panchenko, S.Y. & Vetrov, V.V. (1986). [Breeding of the Levant Sparrowhawk in the Voroshilovgra region]. *Vestnik Zoologii* 1: 50-53. In Russian.
- Leutenant, R.M. (1993). Edward's Pheasant: important challenge for aviculture. *Game Bird Breeders Convers.* 40: 41(12): 15-16.
- Leveque, R. (1960). Observaciones sobre Águila Imperial en Doñana, abril-mayo 1959. *Ardeola* 6: 381.
- Lever, C. (1987). *Naturalized Birds of the World*. Longman Scientific & Technical, Harlow, UK.
- Levickulm, P. (1993). Kaiseradler und Aasgier an Hirs. Pp. 218-230 in: *Proc. IV Int. Orn. Congr.* London, 1993.
- Levy, N. (1989). Information-sharing and/or information-concealment by the Egyptian Vulture. *Israel J. Zool.* 36: 147-176.
- Levy, N. (1990). *Biology, Population Dynamics and Ecology of the Egyptian Vultures*. Neophron percnopterus, in Israel. MSc thesis, Tel-Aviv University.
- Levy, N. (1991). Feeding habits and food composition of the Egyptian Vulture *Neophron percnopterus* in Israel. *Israel J. Zool.* 37(3): 169-170.
- Levy, N. & Mendelsohn, H. (1989). Egyptian Vultures: feeding behavior. *Israel Land & Nature* 14: 126-131.
- Lewin, V. (1963). Reproduction and development of young in a population of California Quail. *Condor* 65: 249-278.
- Lewin, V. (1965). The introduction and status of California Quail in the Okanagan Valley of British Columbia. *Condor* 67: 61-66.
- Lewin, V. & Lewin, G. (1984). The Kalij Pheasant, a newly established game bird on the island of Hawaii. *Wilson Bull.* 96: 634-646.
- Lewis, A. & Pomeroy, D. (1989). *A Bird Atlas of Kenya*. A. Balkema, Rotterdam.
- Lewis, F. (1940). Notes on the breeding habits of the Malleefowl. *Emu* 40: 96-110.
- Lewis, J.B. & Breitenbach, R.P. (1966). Breeding potential of subadult Wild Turkey gobblers. *J. Wildl. Manage.* 30(3): 618-622.
- Lewis, J.C. (1973). *The World of the Wild Turkey*. Lippincott Co, Philadelphia, Pennsylvania.
- Lewis, M.J. (1987). Australian Kestrels *Falco cenchroides* feeding on bats. *Austr. Bird Watcher* 12: 126-127.
- Lewis, R.A. (1979). *Suitability and Selection of Territorial Sites Used by Male Blue Grouse*. MSc thesis, University of Alberta, Edmonton, Canada.
- Lewis, R.A. (1984a). Evidence of aggressive behavior in female Blue Grouse. *Auk* 101: 195-196.
- Lewis, R.A. (1984b). Non-territorial adult males and breeding densities of Blue Grouse. *Wilson Bull.* 96: 723-725.
- Lewis, R.A. (1984c). Density, movements and breeding success of female Blue Grouse in an area of reduced male density. *Can. J. Zool.* 62: 1556-1560.
- Lewis, R.A. (1985). Do Blue Grouse form leks? *Auk* 102: 180-183.
- Lewis, R.A. & Zwickel, F.C. (1980). Removal and replacement of male Blue Grouse on persistent and transient territorial sites. *Can. J. Zool.* 58: 1417-1423.
- Lewis, R.A. & Zwickel, F.C. (1981). Differential use of territorial sites by male Blue Grouse. *Condor* 83: 171-176.
- Lewis, R.A. & Zwickel, F.C. (1982). Survival and delayed breeding in male Blue Grouse. *Can. J. Zool.* 60: 1881-1884.
- Lewis, R.E. (1986). A rain-forest raptor in danger. *Oryx* 20: 170-175.
- Lewis, S.E. & Timm, R.M. (1991). Predation on nestling Bare-throated Tiger-herons by a Great Black Hawk. *Ornithol. Neotrop.* 2(1): 37.
- Ley, A.J. (1990). Two breeding records of the Pacific Baza in inland New South Wales. *Austr. Bird Watcher* 13: 258-259.
- Ley, A.J. (1991). A sighting of the Grey Falcon in northern New South Wales. *Austr. Bird Watcher* 14: 28.
- Li Bing-hua (1985). Elliot's Pheasant in S. Anhui. *Chinese Wildlife* 27: 18-20.
- Li Bing-hua & Chen Bi-hui (1984). A preliminary investigation of the geographical distribution and the ecology of the Silver Pheasant *Lophura nymchamera* in South Anhui Province, China. *Chinese J. Zool.* 4(4): 15-18.
- Li Cheng-jie, Liu Huan-jin et al. (1984). Historical data and notes of the Brown Eared-pheasant. *Chinese Wildlife* 19: 12-13.
- Li Chun-qu & Li De-hao (1981). Blue Eared-pheasant *Crossoptilon auritum* and Blood Pheasant *Ithaginis cruentus* in the forestry Qi lian, Qinghai. *Zool. Res.* 2(1): 77-82.
- Li Fu-ai & Huang Shi-guang (1985a). A study on the moulting of the chicks of Brown Eared-pheasant *Crossoptilon manchuricum*. *Acta Zool. Sinica* 31(3): 290-295.
- Li Fu-ai & Huang Shi-guang (1985b). On the moults of the juvenile and post-juvenile Golden Pheasant *Chrysolophus pictus*. *Zool. Res.* 6(4): 337-344.
- Li Fu-ai, Chou Bing-xing et al. (1985). Breeding records of the Chinese Monal Pheasant, *Lophophorus thuyaili*. *Chinese Wildlife* 3: 45-46.
- Li Gui-yuan (1988). The Endemic pheasant in China - The Blue Eared-pheasant *Crossoptilon auritum* Pallas. *Chinese J. Zool.* 2: 38-50.
- Li Gui-yuan, Liu Liang-tsai et al. (1974). Discovery of the female of the Szechwan Hill-partridge *Arborophila rufpectus*. *Acta Zool. Sinica* 20(4): 421-422.
- Li Gui-yuan & Zhang Qing-mao (1987). A field investigation of the Blood Pheasant *Ithaginis cruentus* in Wangliang Natural Reserve, Sichuan Province. *Sichuan J. Zool.* 6(1): 18-21.
- Li Huan-hua & Shen Lan-tian (1983). A pheasant with horn - the Fukien Tragopan *Tragopan caboti*. *Nature* 2: 55.
- Li Huan-hua & Shen Lan-tian (1985). Distribution and ecology of the Fukien Tragopan *Tragopan caboti* guangxiensis in Guangxi. *La Animala Mondo* 3(1): 15-20.
- Li Wen-fa & Zhao Ying-jie (1987). Artificial incubation and raising Daurian Partridge, *Perdix dauurica*. *Chinese Wildlife* 1: 22-23.
- Li Xiang-tao (1986). On the breeding ecology of the Red-bellied Tragopan *Tragopan temminckii*. *Mem. Beijing Nat. Hist. Mus.* 39: 1-8.
- Li Xiang-tao (1987a). On the breeding habits of the Red-bellied Tragopan *Tragopan temminckii*. *Acta Zool. Sinica* 33(1): 99-199.
- Li Xiang-tao (1987b). Survey of the Crimson-bellied Tragopan *Tragopan temminckii*. *Nature* 3: 12-13.
- Li Xiang-tao (1988). Breeding ecology of the Golden Pheasant *Chrysolophus pictus*. *Chinese Wildlife* 4(4): 14-15.
- Li Xiang-tao (1993). Surveys of the Brown Eared-pheasant in Dongling Mountain, Beijing. Pp. 139-140 in: Jenkins (1993).
- Li Xiang-tao & Lu Xiao-yi (1990). Winter ecology of Crimson-bellied Tragopans. Pp. 60-61 in: Hill et al. (1990).
- Li Xiang-tao & Lu Xiao-yi (1992). Status and ecology of the Snow Partridge (*Lerwa lerwa callipygia*) in South-western China. Pp. 617-624 in: Birkan, Potts et al. (1992).
- Li Xiao-hui, Tan Hong-Zhi, Chen Cai-An & Zhang Ai-Li (1990). Ecological studies on the White-browed Hill-partridge. Page 84 in: Hill et al. (1990).
- Li Xiao-hui, Tan Hong-Zhi, Chen Cai-An & Zhang Ai-Li (1992). Domestication and breeding of the White-browed Hill-partridge *Arborophila ginseng* in China. Pp. 765-771 in: Birkan, Potts et al. (1992).
- Liao Yan-fa (1984). Ecology of the Blue Eared-pheasant *Crossoptilon auritum*. *Chinese Wildlife* 2: 10-13.
- Liao Yan-fa (1985a). The development of the Blue Eared-pheasant. *Chinese Wildlife* 24: 31-34.
- Liao Yan-fa (1985b). Raising of the Blue Eared-pheasant *Crossoptilon auritum*. *Chinese Wildlife* 2: 31-34.
- Liao Yan-fa et al. (1984). Living habits of the Blue Eared-pheasant. *Chinese Wildlife* 18: 10-13.
- Liedlich, D.W., Lockwood, D.R., Schmitz, S.D., Sutcliffe, D.H. & Haussamen, W.C. (1991). *Merrill's Wild Turkey Reproductive Ecology in the Sacramento Mountains. South-Central New Mexico*. Agricultural Experiment Station Bulletin 57. New Mexico State University, Las Cruces, New Mexico.
- Ligon, J.D. (1967). Relationships of the cathartid vultures. *Ocas. Pap. Mus. Zool. Univ. Mich.* 651.
- Ligon, J.S. (1927). *Wildlife of New Mexico, its Conservation and Management*. New Mexico State Game Commission. Santa Fe, New Mexico.
- Ligon, J.S. (1952). The vanishing Masked Bobwhite. *Condor* 54: 48-50.
- Ligon, J.S. (1961). *New Mexico Birds and Where to Find Them*. University of New Mexico Press, Albuquerque.
- Likhatchev, G.N. (1957). [Studies on the breeding of large birds of prey in a deciduous forest]. Pp. 308-336 in: *Trudy vityaj Pribaltiskoj orn. Konf. Moscow*. In Russian.
- Lin S.-s. & Lin M.-h. (1986). *A Survey of Grey-faced Buzzard-Eagle Hunting in ManChow Area*. Conservation Research Report 10. Ken Ting National Park.
- Lincer, J.L., Clark, W.S. & LeFranc, M.N. (1979). *Working Bibliography of the Bald Eagle*. National Wildlife Federation of Science Technical Series 2, Washington, D.C.
- Lincoln, G.A. (1974). Predation of Incubator Birds (*Megapodius freycineti*) by Komodo Dragons (*Varanus komodoensis*). *J. Zool., London* 174: 419-428.
- Lindberg, P. (1975). *Pilgrimsfalken i Sverige*. Svenska Naturskyddsforeningen, Stockholm.
- Lindberg, P. (1981). Ovanliga bytesdjur funna i bon av juktalf *Falco rusticolus* och pilgrimsfalk *Falco peregrinus*. *Vår Fågelvärld* 40.
- Lindeman, G.V. (1977). [The Steppe Eagle in the area between the Volga and Kama Rivers]. Pp. 226-228 in: *Mut. VII Vsesojuzn. ornit. konf. Kiev*. Part 2. In Russian.
- Lindeman, G.V. (1983). [Construction and distribution of nests of the Steppe Eagle in the area between the Volga and Ural Rivers]. Pp. 136-138 in: *[Conservation of Birds of Prey]*. Moscow. In Russian.
- Lindén, H. (1981a). Estimation of juvenile mortality in the Capercaillie *Tetrao urogallus* and the Black Grouse *Tetrao tetrix* from indirect evidence. *Finnish Game Res.* 39: 35-51.
- Lindén, H. (1981b). Hunting and Tetraonid populations in Finland. *Finnish Game Res.* 39: 35-51.
- Lindén, H. (1981c). Does duration and predictability of the winter affect the wintering success of the Capercaillie, *Tetrao urogallus*? *Finnish Game Res.* 39: 53-67.
- Lindén, H. (1984a). Variation in clutch size and egg size of Capercaillie and Black Grouse. *Suomen Riista* 31: 44-50.
- Lindén, H. (1984b). The role of energy and resin contents in the selective feeding of pine needles by the Capercaillie. *Ann. Zool. Fennici* 21: 435-439.

- Lindén, H. (1989a). [The Capercaillie in winter]. *Stamen Riista* 35: 61-71. In Finnish.
- Lindén, H. (1989b). Characteristics of tetraonid cycles in Finland. *Finnish Game Res.* 46: 34-42.
- Lindén, H. & Rajala, P. (1981). Fluctuations and long term trends in the relative densities of tetraonid populations in Finland, 1964-1977. *Finnish Game Res.* 39: 13-34.
- Lindén, H. & Wikman, M. (1983). Goshawk predation on tetraonids: availability of prey and diet of the predator in the breeding season. *J. Anim. Ecol.* 52: 953-968.
- Lindgard, K. & Stokkan, K.A. (1989). Daylength control of food intake and body weight in Svalbard Ptarmigan *Lagopus mutus hyperboreus*. *Ornis Scand.* 20: 176-180.
- Lindgren, E. (1972). Courtship display of the White-breasted Sea-Eagle. *Aust. Bird Watcher* 4: 132-133.
- Lindroth, H. & Lindgren, H. (1950). On the significance for forestry of the Capercaillie feeding on pine needles. *Stamen Riista* 5: 60-81.
- Lindsey, A.L.G. (1979). A feeding association between Australian Fernwren and Orange-footed Scrubfowl. *Sunbird* 10: 47.
- Linsdale, J.M. (1936). California Quail feeding on acorns. *Condor* 38: 126.
- Lint, K.C. (1952). Breeding Ocellated Turkeys in captivity. *Bull. Zool. Soc. San Diego* 27.
- Lippens, L. & Wille, H. (1976). *Les Oiseaux du Zaïre*. Editions Lannoo Tielt, Belgium.
- Lister, J.J. (1911). The distribution of the avian genus *Megapodius* in the Pacific Islands. *Proc. Zool. Soc. London* 1911: 749-759.
- Little, R.M. (1990). Hunting Greywing Francolin. *Pelea* 9: 121-123.
- Little, R.M. (1992). *Population Genetics, Behavioural Ecology and Management of the Greywing Francolin*. *Francolinus africanus*. PhD Thesis, University of Cape Town.
- Little, R.M. & Crowe, T.M. (1992a). Vocal behaviour of the Greywing Francolin *Francolinus africanus* can be used to estimate population density. *Ostrich* 63: 98-109.
- Little, R.M. & Crowe, T.M. (1992b). The use of morphometrics and development of plumage in estimating the growth patterns and age of Greywing Francolin *Francolinus africanus*. *Ostrich* 63: 172-179.
- Little, R.M. & Crowe, T.M. (1992c). Population ecology and conservation of the Greywing Francolin *Francolinus africanus*. In: Birkan, Potts et al. (1992).
- Little, R.M. & Crowe, T.M. (1993a). The breeding biology of the Greywing Francolin *Francolinus africanus* and its implications for hunting and management. *S. Afr. J. Zool.* 28: 6-12.
- Little, R.M. & Crowe, T.M. (1993b). Hunting efficiency and the impact of hunting on Greywing Francolin populations. *S. Afr. J. Wildl. Res.* 23: 31-35.
- Little, R.M., Earle, R.A., Crowe, T.M. & Huchzermeyer, F.W. (1993). Mortality caused by histomoniasis in young Greywing Francolin. *S. Afr. J. Wildl. Res.* 23(2): 57-58.
- Little, R.M., Gous, R.M. & Crowe, T.M. (1993). The distribution and abundance of Greywing Francolin. *Francolinus africanus*, on the Stormberg Plateau, eastern Cape Province, South Africa, in relation to diet and substrate. *Ostrich* 64: 105-114.
- Little, R.M., Grant, W.S. & Crowe, P.G. (1993). A population biology and genetic approach to sustainable hunting of the Greywing Francolin *Francolinus africanus* (extended abstract). Page 76 in: Wilson (1993).
- Little, R.M., Grant, W.S. & Crowe, T.M. (1991). Population genetics and conservation of the Greywing Francolin *Francolinus africanus*. Page 17 in: *ZSSA programme and abstracts* (abstract).
- Little, R.M., Grant, W.S. & Crowe, T.M. (1993). Does hunting affect the demography and genetic structure of the Greywing Francolin (*Francolinus africanus*)? *Biodiversity & Conservation* 2: 567-585.
- Little, R.M., Verster, A. & Crowe, T.M. (1993). Seasonal and demographical variation in intestinal helminth infection of Greywing Francolin. *Ostrich* 64: 178-181.
- Little, T.W. (1978). *Populations, Distributions and Habitat Selection by Drumming Male Ruffed Grouse in Central Minnesota Prior to Clearcutting*. PhD thesis, University of Minnesota, St. Paul.
- Little, T.W. & Varland, K.I. (1981). Reproduction and dispersal of transplanted Wild Turkeys in Iowa. *J. Wildl. Manage.* 45(2): 419-427.
- Littellfield, C.D., Thompson, S.P. & Ehlers, B.D. (1984). History and present status of Swainson's Hawks in southeast Oregon. *J. Raptor Res.* 18: 1-6.
- Littellfield, C.D., Thompson, S.P. & Johnstone, R.S. (1992). Rough-legged Hawk habitat selection in relation to livestock on Malheur National Wildlife Refuge, Oregon. *Northwestern Naturalist* 73(3): 80-84.
- Litun, V.I. (1982). Sex and age determination in Bearded Partridges *Perdix dauuricae*. *Ekologiya* 3: 69-70.
- Litun, V.I. (1983). [Daurian Partridge ecology in southern Transbaikalia]. *Byull. Mosk. Ova Ispyt. Prirod. Biol.* 88: 25-32. In Russian.
- Litun, V.I. (1984). Bearded Partridge population structure in different phases of number dynamics. Pp. 68-69 in: *Mit. XIV Vsesoyuzn. ornit. kongr. Sverdlovsk*. Part 2. In Russian.
- Litun, V.I. (1987). Population dynamics and productivity of a Daurian Partridge *Perdix dauuricae* in the southern Transbaikalia. *Abstr. Congr. Internat. Union Game Biol. Jagellonian University*. Krakow, 18: 104-105.
- Litun, V.I. (1991). Dynamics and productivity of Daurian Partridges in the Southern Transbaikalia. *Trans. Congr. Internat. Union Game Biol.* 18(1): 605-607.
- Litun, V.I. (1992). Immature sex ratio and autumn population density of Bearded Partridges *Perdix dauuricae*. Pp. 371-376 in: Birkan, Potts et al. (1992).
- Litvinenko, N.M. ed. (1988). [Rare birds of the Far East and their protection]. Academy of Sciences, Vladivostok. In Russian.
- Liu Huan-jin & Lu Xin (1988). The geographical distribution, habitat and protection of the Brown Eared-pheasant (*Crossoptilon mitchurcui* Swinhoe). *Chinese J. Zool.* (5): 33-36.
- Liu Huan-jin & Su Hua-long (1987). Feeding, water drinking and sand bathing of the Brown Eared-pheasant (*Crossoptilon mitchurcui* Swinhoe). *Nature* (2): 42-44.
- Liu Huan-jin, Feng Jing-yi et al. (1986). Preliminary observations on the ecology of the Upland Buzzard *Buteo hemilasius* in winter and in spring. *J. Biol.* (1): 20-24.
- Liu Huan-jin, Su Hua-long & Shen Shou-yi (1991). [On the population of the Brown Eared-pheasant at Pangqiangou National Nature Sanctuary, Shanxi Province, China]. *Acta Zool. Sinica* 37(1): 30-35. In Chinese with English summary.
- Liu Huan-jin, Su Hua-long et al. (1987). A preliminary study on population ecology of the Brown Eared-pheasant *Crossoptilon mitchurcui* in the nature sanctuary of Pangqiangou (Shanxi Province). *Chinese J. Zool.* (5): 44-48.
- Liu Ming-yu, Guo Gui-hua et al. (1986). Technical study report regarding artificial breeding of the Chukar Partridge *Alectoris graeca*. *Trans. Lianoning Zool. Soc.* 6(1): 61-67.
- Liu N. & Geng Z. (1994). Reproduction of Severov's Hazel Grouse (*Bonasa sewerzovi*). *Gilbert Faune Sauvage* 11(1): 39-49.
- Liu Nai-fa (1984). On the taxonomic status of the Przewalski's Rock Partridge *Alectoris magna*. *Acta Zootaxonomica Sinica* 9(2): 212-218.
- Liu Nai-fa (1990). Studies of geographic variation of Strauch's Pheasant. Pp. 29-30 in: Hill et al. (1990).
- Liu Nai-fa (1992). Ecology of Przewalski's Rock Partridge *Alectoris magna*. Pp. 605-612 in: Birkan, Potts et al. (1992).
- Liu Nai-fa & Wang Xiang-ting (1986). On the validity of *Phasianus colchicus szechuanensis*. *Acta Zool. Sinica* 32(3): 299-300.
- Liu Nai-fa & Yang You-tao (1982). Ecological studies of the Chukar Partridge *Alectoris graeca magna*. *Zool. Res.* 3(1): 69-76.
- Liu Nai-fa, Chang C. & Wang Xiang-ting (1990). Ecological studies of the Himalayan snowcock. Pp. 35-37 in: Hill et al. (1990).
- Liu Nai-fa, Yang You-tao et al. (1984). The subspecies differentiation of the Ring-necked Pheasant in Gansu Province and their geographical variations. *Chinese Wildlife* 18(2): 6-9.
- Liu Ru-sun (1986a). The taxonomy of eared-pheasants. In: Ridley (1986a).
- Liu Ru-sun (1986b). The taxonomy of eared-pheasants. *J. World Pheasant Assoc.* 11: 40-43.
- Liu Ru-sun (1988). Studies on the reproductive behaviour of the Brown Eared-pheasant *Crossoptilon mitchurcui*. *Zool. Res.* 7(3): 243-249.
- Liu Ru-sun & Lu Jue-chun (1990). The taxonomy of the ruffed pheasants. Pp. 95-97 in: Hill et al. (1990).
- Liu Ru-sun, Guo Yan-jun et al. (1985). Study on electrofocusing technique on the relationship between three species of the genus *Crossoptilon*. *Acta Zool. Sinica* 31(3): 206-213.
- Liu Tsomo (1990). [The sea eagle found in China]. *J. Shanxi Univ. Nat. Sci. Ed.* 13(3): 328-333. In Chinese with English summary.
- Liu Xiao-hua, Zhou Fang, Pan Guo-ping, Lai Yue-mai, Zheng Yich-nan, Liu Zi-min & Ao De-jiang (1990). A preliminary study of the feeding habits of the Black-necked Bar-tailed Pheasant in Guangxi. Page 79 in: Hill et al. (1990).
- Lorenz, R. (1962). The breeding biology of the Little Sparrowhawk *Accipiter minillius*. *Ibis* 105: 499-506.
- Lorenz, R. (1963). The breeding biology of the Great Sparrowhawk *Accipiter gentilis*. *Ibis* 106: 499-506.
- Lobachev, V.S. (1960). [Materials on the biology of the Imperial Eagle in the NE Aral area]. *Ornitologiya* 3: 306-314. In Russian.
- Lobachev, V.S. (1964). [Special dedication of the Imperial Eagle within its breeding range]. *Avstr. All-Union Symp. Conf. Young Scientists*. Leningrad, Moscow: State University. 3: 46-47. In Russian.
- Lobachev, V.S. (1967). [The food of the Imperial Eagle in the NE Aral area]. *Ornitologiya* 8: 366-368. In Russian.
- Lobko-Lobanovskij, M.N. & Zilin, A.F. (1962). [On the breeding biology of the Black-billed Capercaillie in Kamchatka]. *Ornitologiya* 5: 164-165.
- Lobkov, E.G. (1971). *Haliaeetus pelagicus* on Kamchatka peninsula. *Zool. Zashch. Mirov* 57: 1048-1059. In Russian.
- Lobkov, E.G. (1991). Die Population des Riesenseeadlers *Haliaeetus pelagicus* Pallas auf Kamtschatka und Probleme ihres Schutzes. *Populationsik. Greifvögel u. Eulenarten* 2: 141-151.
- Lobkov, E.G. & Neufeldt, I.A. (1986). [Distribution and biology of Steller's Sea Eagle *Haliaeetus pelagicus* (Pallas)]. *Proc. Zool. Inst. Acad. Sci. USSR, Leningrad* 150: 107-146. In Russian.
- Lobkov, E.G. & Zueva, L.M. (1983). [Insecurity Burden] in the population of Steller's Sea Eagle in Kamchatka. Environmental factors reducing breeding success. Pp. 30-33 in: [Ecology of Birds of Prey]. Proceedings of the 1st Conference on Ecology and Protection of Birds of Prey. Nauka, Moscow. In Russian.
- Lobkov, E.G., Piskovetsky, A.A. & Alekseev, S.A. (1988). [Distribution and number of the Steller's Sea Eagle on Kamchatka in winter 1985 and 1986. The First International census]. Pp. 91-103 in: Litvinenko (1988). In Russian.
- Lokemoen, J.T. & Duebber, H.F. (1976). Ferruginous Hawk nesting ecology and raptor populations in northern South Dakota. *Condor* 78: 464-470.
- Long Di-zong (1985). Ecology of the White-necked Long-tailed Pheasant. *Chinese Wildlife* 23(1): 24-25.
- Long Guo-zhen (1982). [Studies on the breeding biology of the Pied Harrier *Circus melanoleucos*]. *Chinese J. Zool.* 16(1): 31-33. In Chinese.
- Lönnerberg, E. (1923). Some remarks on palearctic goshawks. *Ibis* Ser. II: 211-217.
- Loof, V. (1981). Habicht - *Accipiter gentilis*. In: Loof, V. & Busche, G. (1981). *Vogelwelt Schleswig-Holstein*. Vol. 2: Greifvögel. Wachholtz, Neumünster.
- Loosemore, E. (1963). Grey Kestrel in Tanganyika. *J. East Afr. Nat. Hist. Soc.* 24: 67-70.
- Louette, M. (1981). *The Birds of Cameroon: An Annotated Check-list*. Palais de l'Académie, Brussels.
- Louette, M. (1988). *Les Oiseaux des Comores*. Musée Royal de l'Afrique Centrale, Tervuren, Belgium.
- Louette, M. (1991). The Red-tailed Buzzards of Zaïre. *Bull. Brit. Orn. Club* 111: 51-55.
- Louette, M. (1992). The identification of forest Accipiters in central Africa. *Bull. Brit. Orn. Club* 112(1): 50-53.
- Love, D., Grzybowski, J.A. & Knopf, F.L. (1985). Influence of various land uses on windbreak selection by nesting Mississippi Kites. *Wilson Bull.* 97: 561-565.
- Love, J.A. (1983). *The Return of the Sea Eagle*. Cambridge University Press, Cambridge.
- Love, J.A. (1988). *The Reintroduction of the White-tailed Sea Eagle to Scotland: 1975-1987*. Research & Survey in Nature Conservation Series 12. Nature Conservancy Council, Peterborough.
- Love, J.A. & Ball, M.E. (1979). White-tailed Sea Eagle *Haliaeetus albicilla* reintroduction to the Isle of Rhé. *Scotland 1975-1977*. *Biol. Conserv.* 16: 23-30.
- Love, J.A., Ball, M.E. & Newton, I. (1978). White-tailed Sea Eagles in Britain and Norway. *British Birds* 71 (11): 475-481.
- Lovely, T.E. & Brash, A.R. (1984). Homage au Jean d'Arc or the conservation of the Cracidae. *Dodo* 21: 33-42.
- Lovel, T.W.I. (1976). The present status of the Congo Peacock. *J. World Pheasant Assoc.* 1: 48-57.
- Lovel, T.W.I. (1977). A studybook for the Edwards' Pheasant. *J. World Pheasant Assoc.* 2: 97-99.
- Lovel, T.W.I. ed. (1979). *Woodland Grouse Symposium*, 1978. Proceedings of the First International Symposium on Grouse, held December 4-8, 1978, Inverness, Scotland. World Pheasant Association, Larnach, England.
- Lovel, T.W.I. ed. (1982). *Grouse*. Proceedings of the Second International Symposium on Grouse, March 16-20, 1981, Edinburgh. World Pheasant Association, Larnach, England.
- Lovel, T.W.I. & Hudson, P.J. eds. (1985). *Third International Grouse Symposium*, York, 1984. World Pheasant Association, Reading, UK.
- Lovel, T.W.I. & Hudson, P.J. eds. (1988). *Fourth International Grouse Symposium*, 1987. World Pheasant Association, Reading, UK.
- Lowe, C. (1978). *Certain Life History Aspects of the Red-tailed Hawk*. Central Oklahoma and Interior Alaska, MSc thesis, University of Alaska, Fairbanks.
- Lowe, P.R. (1925). Some notes on the genus *Polyplectron*. *Ibis* 12: 1: 476-84.
- Lowe, P.R. (1938). Some preliminary notes on the anatomy and systematic position of *Afrapeto cingensis* Chapin. Pp. 219-230 in: *Proc. IX Int. Orn. Congr. Rouen*, 1938.
- Lowe, V.T. & Lowe, T.G. (1976). Spotted Harrier nesting. *Aust. Bird Watcher* 6: 252-254.
- Lowery, G.H. & Dalquest, W.W. (1951). *Birds from the State of Veracruz, Mexico*. Museum of Natural History, University of Kansas Publications 3, Lawrence, Kansas.
- Lowery, G.J. & Newman, R.J. (1951). Notes on the ornithology of south-eastern San Luis Potosí. *Wilson Bull.* 63: 315-322.
- Lowther, E.H.N. (1949). *A Bird Photographer in India*. Oxford University Press.
- Lu Tai-chun (1985). A field investigation of the Chinese Monal *Lophophorus lhuysii*, Sichuan Province. *Sichuan J. Zool.* 4(1): 15.
- Lu Tai-chun (1986). On the breeding ecology of the Tibetan Eared-pheasant. *Acta Zool. Sinica* 32(4): 369-374.
- Lu Tai-chun & Lu Ru-sun (1983). Brown Eared-pheasant *Crossoptilon mitchurcui*: studies of its ecology and biology. *Acta Zool. Sinica* 29(3): 278-290.
- Lu Tai-chun, He Fen-qi & Liu Ru-sun (1986). The Chinese Monal: studies of its ecology and biology. In: Ridley (1986a).
- Lu Tai-chun, He Fen-qi et al. (1986). On the call of the Chinese Monal *Lophophorus lhuysii*. *Acta Zool. Sinica* 6(1): 87-88.
- Lu Tai-chun, Lu Ru-sun et al. (1986). An ecological study of the Chinese Monal *Lophophorus lhuysii*. *Acta Zool. Sinica* 32(3): 273-279.
- Lu Tai-chun, Lu Ru-sun et al. (1989). Ecology and systematic relationships of three species of the genus *Crossoptilon*. *Sichuan J. Zool.* 8(2): 21-23.
- Lu Tai-chun, Lu Ru-sun, He Fen-qi & Lu C.-L. (1990). Notes on the distribution and ecology of the three species of the genus *Crossoptilon*. Pp. 92-93 in: Hill et al. (1990).
- Lucio, A.J. (1989). *Bioecología de la Perdiz Roja en León. Bases para la Gestión Cinegética*. PhD thesis, Universidad de León, Spain.
- Lucio, A.J. (1990). Influencia de las condiciones climáticas en la productividad de la Perdiz Roja (*Alectoris rufa*). *Ardeola* 37: 207-218.
- Lucio, A.J. (1991). Selección de hábitat de la Perdiz Roja (*Alectoris rufa*) en matorrales supramediterráneos del NW de la Cuenca del Duero. Aplicaciones para la gestión del hábitat cinegético. *Ecología* 5: 337-353.
- Lucio, A.J. & Purroy, F.J. (1985). Contribución al conocimiento demográfico de las Phasianidae de León. *Bol. Estac. Centr. Ecol. Zool.* 27: 89-97.
- Lucio, A.J. & Purroy, F.J. (1987). Selección de hábitat de *Alectoris rufa* en la llanura del SE de León. Pp. 255-264 in: *Acta I Congreso Internacional de Aves Estructuras León*.
- Lucio, A.J. & Purroy, F.J. (1992). Red-legged Partridge (*Alectoris rufa*) habitat selection in northwest Spain. Pp. 417-429 in: Birkan, Potts et al. (1992).
- Lucking, R.S., Davidson, P.J.A. & Stones, A.J. (1992). The status and ecology of the Sula Scrubfowl *Megapodius bernsteini* on Taliabu, Maluku, Indonesia. *Megapode News* 6(2): 15-22.
- Ludlow, E. (1951). The birds of Kongo and Pome, south-east Tibet. *Ibis* 93: 547-578.
- Ludlow, E. & Kinnear, N.B. (1944). The birds of south-east Tibet. *Ibis* 86: 348-89.
- Lutich, S. (1979). Fish and wildlife concerns and recommendations for Northern Mariana Islands, based on July 1978 field trip. Unpublished field report to US Fish & Wildlife Service, Honolulu.
- Lutich, S. (1992). Feeding of the Acta Snowcock *Tetraogallus altaicus* at the Altai Mountains. Pp. 633-642 in: Birkan, Potts et al. (1992).
- Lutich, S. (1993). Altai Snowcock. *World Pheasant Assoc. News* 40: 13-15.
- Lumsden, H.G. (1961a). Displays of the Spruce Grouse (*Aves: Tetraonidae*). *Can. Field-Nat.* 75: 152-160.
- Lumsden, H.G. (1961b). The display of the Capercaillie. *British Birds* 54: 257-272.
- Lumsden, H.G. (1963). *Display of the Spruce Grouse*. Ontario Department of Lands and Forests Technical Research Report 66.
- Lumsden, H.G. (1966). The Prairie Chicken in southwestern Ontario. *Can. Field-Nat.* 80: 33-35.
- Lumsden, H.G. (1968). *The Display of the Spruce Grouse*. Ontario Department of Lands and Forests Technical Research Report 83.
- Lumsden, H.G. & Weeden, R.B. (1963). Notes on the harvest of Spruce Grouse. *J. Wildl. Manage.* 27: 587-591.
- Lunde, E. (1985). *Systematik og økologi av de norske fjellgjøkter*. *Levin S. Sævi, Oslo*. University of Oslo, Norway.
- Lundestad, C. & Rosenburg, E. (1984). Some aspects of the behavior and breeding biology of the Harrier (*Circus macrurus*). Pp. 599-603 in: *Proc. XI Int. Orn. Congr. Basel*, 1984.
- Lundy, V.E. (1957). Has the nest of the King Vulture finally been found? *Animal Kingdom* 60: 117-121.
- Lupo, C., Beani, L., Cervo, R., Lodi, L. & Dessì-Fulgheri, F. (1990). Steroid hormones and reproductive history in the Goshawk *Accipiter nisus*. *Birds* 87: 34-39.
- Lutich, S., Keith, L.B. & Stephenson, J.R. (1993). Population dynamics of the Red-tailed Hawk (*Buteo lineatus*) at Rochester, Alberta. *Auk* 88: 75-87.

- Lutz, R.S. (1979). *The Response of Attwater's Prairie Chicken to Petroleum Development*. MSc thesis, Texas A & M University Press, College Station.
- Lutz, R.S. & Crawford, J.A. (1987a). Seasonal use of roost sites by Merriam's Wild Turkey hens and hen-poult flocks in Oregon. *Northwest Science* 61(3):174-178.
- Lutz, R.S. & Crawford, J.A. (1987b). Reproductive success and nesting habitat of Merriam's Wild Turkey in Oregon. *J. Wildl. Manage.* 51(4):783-787.
- Lynn-Allen, G. (1951). *Shotgun and Sunlight: The Game Birds of East Africa*. The Batchworth Press, London.
- Lyon, B. & Kuhnigk, A. (1985). Observations on nesting Ornate Hawk-eagles in Guatemala. *Wilson Bull.* 97(2):141-147.
- Lyon, D.L. (1962). Comparative growth and plumage development in Coturnix and Bobwhite. *Wilson Bull.* 74:5-27.
- Lyns, D.L. & Mosher, J.A. (1982). Food caching and cannibalism by the Broad-winged Hawks. *Ardea* 70:217-219.
- Ma Li (1992). The breeding ecology of the Himalayan Snowcock (*Tetrao galus himalayensis*) in the Tian Shan Mountains (China). Pp. 625-632 in Birkan, Potts et al. (1992).
- Ma Guo-yao (1988). First record of the Chinese Monal *Lophophorus thuyi* from Gansu Province. *Sichuan J. Zool.* 7(2):41-42.
- Macdonald, I.A.W. (1986). Do Redbreasted Sparrowhawks belong in the Karoo? *Bokmakierie* 38:3-4.
- Macdonald, I.A.W. & Gargett, V. (1984). Raptor density and diversity in the Matopos, Zimbabwe. Pp. 287-308 in: Ledger (1984).
- Macdonald, J.D. (1957). *Contribution to the Ornithology of Western South Africa*. Trustees of the British Museum, London.
- Macdonald, J.D. (1988). *Birds of Australia*. Reed, Frenchs Forest, Australia.
- Macdonald, M.A. (1980a). Further notes on uncommon forest birds in Ghana. *Bull. Brit. Orn. Club* 100:170-172.
- Macdonald, M.A. (1980b). Breeding of the Black Kite in southern Ghana. *Ostrich* 51:118-120.
- Macdonald, M.A. & Taylor, I.R. (1977). Notes on some uncommon forest birds in Ghana. *Bull. Brit. Orn. Club* 97:116-120.
- Macdonald, S.D. (1968). The courtship and territorial behavior of Franklin's race of the Spruce Grouse. *Living Bird* 7:5-25.
- Macdonald, S.D. (1970). The breeding behavior of the Rock Ptarmigan. *Living Bird* 9:125-238.
- Macedo, H.D. (1964). Cursus cas de nidification du *Buteo pascillochrous* Gurney sur *Puya raimondii*. *Oiseau et RFO* 34:199-203.
- Macedo-Ruiz, H. (1978). Redécouverte du cracidé *Penelope albipennis* dans les forêts sèches du nord-ouest du Pérou. *C. R. Acad. Sci. Paris* 287 (Ser. D):265-267.
- Macedo-Ruiz, H. (1979a). Redescubrimiento de la Pava Aliblanca *Penelope albipennis* Taczanowski 1877. *Boletín de Loma* 1:5-11.
- Macedo-Ruiz, H. (1979b). "Extinct" bird found in Peru. *Orex* 15:33-37.
- Mackay, R.D. (1988). Gurney's Eagle *Aquila gurneyi* in the highlands. *Mural* 3:56.
- Mackay, R.D. (1991). Papuan Harrier *Circus spilothorax* in north Queensland, with comments on plumages. *Aust. Bird Watcher* 14:144-146.
- Mackie, J.R. & Buchner, H.K. (1963). The reproductive cycle of the Chukar. *J. Wildl. Manage.* 27:246-60.
- Mackinnon, J. (1988). *Field Guide to the Birds of Java and Bali*. Gadjah Mada University Press, Yogyakarta, Indonesia.
- Mackinnon, J. (1978). Sulawesi megapodes. *J. World Pheasant Assoc.* 3:96-103.
- Mackinnon, J. (1981). Methods for the conservation of Maleo birds *Macrocephalon maleo* on the island of Sulawesi. *Indonesia. Biol. Conserv.* 20:183-193.
- Mackinnon, J. & Phillips, K. (1993). *A Field Guide to the Birds of Borneo, Sumatra, Java and Bali*. Oxford University Press, Oxford.
- Mackworth-Praed, C.W. & Grant, C.H.B. (1953). On the status of *Pternistis cooperi* Roberts. *Ostrich* 24:123.
- Mackworth-Praed, C.W. & Grant, C.H.B. (1957-1973). *African Handbook of Birds*. Longman, London & New York.
- Mackworth-Praed, C.W. & Grant, C.H.B. (1957). *African Handbook of Birds. Series One. Birds of Eastern and North Eastern Africa*. Vol. 1. Longman, London.
- Mackworth-Praed, C.W. & Grant, C.H.B. (1962). *African Handbook of Birds. Series Two. Birds of the Southern Throat of Africa*. Vol. 1. Longman, London & New York.
- Mackworth-Praed, C.W. & Grant, C.H.B. (1970). *African Handbook of Birds. Series Three. Birds of West Central and Western Africa*. Vol. 1. Longman, London & New York.
- MacLaren, P.A., Runde, D.E. & Anderson, S.H. (1984). A record of tree-nesting Prairie Falcons in Wyoming. *Condor* 84:487-488.
- MacLachy, A.R. (1937). Contribution à l'étude des oiseaux du Gabon méridional. *Oiseau et RFO* 7:60-80.
- Maclean, G.L. (1970). The Pygmy Falcon *Polyborus semitorquatus*. *Koedoe* 13:1-21.
- Maclean, G.L. (1993). *Roberts' Birds of Southern Africa*. 6th edition. Trustees of the John Voelcker Bird Book Fund, Cape Town.
- Madariaga, M. & Yereña de Vega, M. (1981). Estudio preliminar de los cromosomas de los géneros *Crax*, *Mitu* y *Pauxi*. Pp. 62-72 in: Estudillo López (1981).
- Mader, W.J. (1975a). Biology of the Harris' Hawk in southern Arizona. *Living Bird* 14:59-85.
- Mader, W.J. (1975b). Extra adults at Harris' Hawk nests. *Condor* 77(4):482-485.
- Mader, W.J. (1977). Harris' Hawks lay three clutches of eggs in one year. *Auk* 96:370-371.
- Mader, W.J. (1978). A comparative nesting study of Red-tailed Hawks and Harris' Hawks in southern Arizona. *Auk* 95(2):327-337.
- Mader, W.J. (1979a). Breeding behavior of a polyandrous trio of Harris' Hawks in southern Arizona. *Auk* 96(4):776-788.
- Mader, W.J. (1979b). First nest description for the genus *Micrastur* (forest-falcons). *Condor* 81(3):320.
- Mader, W.J. (1981). Notes on nesting raptors in the llanos of Venezuela. *Condor* 83(1):48-51.
- Mader, W.J. (1982). Ecology and breeding habits of the Savanna Hawk in the llanos of Venezuela. *Condor* 84(3):261-271.
- Madge, S.G. (1971). Some notes on the Taita Falcon *Falco fasciatus*. *Bull. Zambian Orn. Soc.* 3:49-50.
- Madge, G.C. (1976). *An Introduction to Malayan Birds*. Malayan Nature Society, Kuala Lumpur, Malaysia.
- Madrid, J.A., Madrid, H.D., Fumes, S.H., López, J., Botzke, R. & Ramos, A. (1991). Reproductive biology and behavior of the Ornate Hawk-eagle in Tikal National Park (*Spizaeus ornatus*). Pp. 93-113 in: Whitacre et al. (1991).
- Madsen, C.R., Sheldrake, T.J. & Leach, J.T. (1982). *Bald Eagle Production in the Great Lakes 1973-81*. U.S. Fish & Wildlife Service, Minnesota.
- de Magalhães, J.C.R. (1977). *Um os crocodavo*. *Tupia* 69:8-11.
- Mäler, V. (1982). Acoustic communication in the Guineafowl (*Nunidia meleagris*): structure and use of vocalizations, and the principles of message coding. *Z. Tierpsychol.* 59:29-83.
- Mäler, V., Raza, O.A.E. & Scheich, H. (1983). Call-system similarity in a ground-living social bird and a mammal in the bush habitat. *Behav. Ecol. Sociobiol.* 12:5-9.
- Mainardi, D. (1963). Immunological distance and phylogenetic relationships in birds. Pp. 103-114 in: *Proc. XIII Int. Orn. Congr.*, Ithaca, New York, 1962.
- Majne, L.S. & Bulmer, R. (1977). *Birds of my Kalam Country*. Auckland University Press, Auckland.
- Makatsch, W. (1953). *Der Schwarm Milan*. Neue Brehm-Bücherei 10. A. Ziemsen Verlag, Wittenberg Luthenstadt.
- Malan, G. (1991). Cooperative hunting by Rednecked Falcons. *Gahar* 6:70-71.
- Malan, G. (1992). Nest-lining used by Pale Chanting Goshawks in the Little Karoo, South Africa. *Gahar* 7:56-61.
- Malan, G. & Brunch, W.R. (1992). Predation on tent tortoise and leopard tortoise hatchlings by the Pale Chanting Goshawk in the Little Karoo. *S. Afr. J. Zool.* 27:33-35.
- Malechin, N.A. & Stukhovich, V.A. (1981). Altai Snowcock. Peculiarities of nesting and propagation. In: *Rare, disappearing and poorly studied birds in the USSR*. Nauka, Moscow.
- Mallherbe, A.P. (1963). Notes on birds of prey and some other observations at Bushok, north of Rustenburg during a recent plague. *Ostrich* 34:95-96.
- Mallherbe, G. (1970). Observations on the breeding of the African Marsh Harrier. *Winaterrand Bird Club News Sheet* 70:1-8.
- Mallingreanu, J.P. & Tucker, C.J. (1988). Large-scale deforestation in the southeastern Amazon basin of Brazil. *Ambio* 17:49-55.
- Mallet, J. (1964). Breeding of the Red-billed Francolin. *Avicult. Mag.* 70:72-73.
- Mullinson, D., Olsen, P.D. & Olsen, J. (1990). A note on the breeding of the Little Eagle *Hieraaetus morphnoides* and other raptors in the Mt. Mugga area. *ACT. Corella* 14:88-91.
- Mullinson, J.C. (1979). The establishment of viable captive populations of endangered bird species with special reference to the White-banded-pheasant *Crossoptilon crossoptilon* at the Jersey Zoological Park. *J. World Pheasant Assoc.* 4:81-93.
- Mullon, D.P. (1987). The winter birds of Eudakh. *Forktail* 3:27-41.
- Muñoz, G.M.O., Marín, C.N. & Cisneros, F.T. (1987). Comparative gastrointestinal morphology of the Kori Bustard and Secretary Bird. *Zoo Biology* 6:243-251.
- von Maltitz, F., Schmitt, M.B. & Biggs, H.C. (1984). Measurements, moult and abundance of the Lizard Buzzard in the Transvaal. *Ostrich* 55:177-181.
- Malzy, P. (1962). Le faune avienne du Mali. *Oiseau et RFO* 32(Special Vol.):1-81.
- Mann, C.F. (1987). A checklist of the birds of Brunei Darussalam. *Brunei Mus. J.* 6:170-212.
- Mann, C.F. (1989). More notable bird observations from Brunei, Borneo. *Forktail* 5:17-22.
- Manoori, J. (1987). Population survey of the Pheasant *Phasianus colchicus* in Iran. Pp. 78-80 in: Savage & Ridley (1987).
- Manzi, A. & Perna, P. (1994). Relationships between Peregrine *Falco peregrinus* and Lanner *F. biarmicus* in the Marches (Central Italy). In: Meyburg & Chancellor (1994a).
- Mañosa, S. (1991). *Biología Trófica. Us de l'Hàbitat i Biologia de la Reproducció de l'Àstor* (*Accipiter gentilis* Linnaeus, 1758) a la Segarra. PhD thesis, University of Barcelona, Spain.
- Mañosa, S. (1994). Goshawk diet in a Mediterranean area of northeastern Spain. *J. Raptor Res.* 28(2):84-92.
- Marchant, J.H., Hudson, R., Carter, S.P. & Whittington, P. (1990). *Population Trends in British Breeding Birds*. British Trust for Ornithology, Tring, UK.
- Marchant, J.H. (1980). Recent trends in Sparrowhawk numbers in Britain. *Bird Study* 27:152-154.
- Marchant, S. (1951). The Scaly Francolin. *Nigerian Field* 16:164-166.
- Marchant, S. (1960). The breeding of some SW Ecuadorian birds. *Ibis* 102:349-382.
- Marchant, S. & Higgins, P.J. (1993). *Handbook of Australian, New Zealand and Antarctic Birds*. Vol. 2. Oxford University Press, Melbourne.
- Marström, V. (1960). Studies on the physiology and ecological background to the reproduction of the Capercaillie *Tetrao urogallus*. *Vitrey* 2:1-85.
- Marström, V. (1979). A review of the Tetraonid situation in Sweden. Pp. 13-16 in: Lovel (1979).
- Marström, V. (1988). The effects of predation on grouse populations. Pp. 1-12 in: Lovel & Hudson (1988).
- Marström, V. & Höglund, N.H. (1981). Factors affecting reproduction of Willow Grouse (*Lagopus lagopus*) in two highland areas of Sweden. *Vitrey* 11:285-314.
- Marström, V. & Kenward, R.E. (1981). Movements of wintering Goshawks in Sweden. *Vitrey* 12:1-35.
- Marström, V. & Kenward, R.E. (1991). Sexual and seasonal variation in condition and survival of Swedish Goshawks (*Accipiter gentilis*). *Ibis* 123:311-327.
- Marström, V., Kenward, R. & Engren, E. (1988). The impact of predation on boreal tetraonids during vole cycles: an experimental study. *J. Anim. Ecol.* 57:859-872.
- Marién, D. (1951). Notes on some pheasants from south-western Asia, with remarks on molt. *Amer. Mus. Novit.* 1518:1-25.
- Marín, M., Carrión, J.M. & Sibley, F.C. (1992). New distributional records for Ecuadorian birds. *Ornitot. Neotrop.* 3(1):27-34.
- Marinkelle, C.J. (1970). Birds of the Serranía de Macuira, Guajira Peninsula, Colombia. *Mitt. Inst. Colombo-Amérind. Invest. Cient.* 4:15-34.
- Marinkovic, S. & Orlandic, L. (1994). Status of the Griffon Vulture *Gyps fulvus* in Serbia. In: Meyburg & Chancellor (1994a).
- Marinkovic, S., Susic, G., Grubac, G., Sotl, J.P. & Simonov, N. (1985). The Griffon Vulture in Yugoslavia. Pp. 131-135 in: Newton & Chancellor (1985).
- Marion, W.R. (1974). Status of the Plain Chachalaca in South Texas. *Wilson Bull.* 86:200-205.
- Marion, W.R. (1976). Plain Chachalaca food habits in south Texas. *Auk* 93:376-379.
- Marion, W.R. (1977). Growth and development of the Plain Chachalaca in south Texas. *Wilson Bull.* 89:47-56.
- Marion, W.R. & Fleetwood, R.J. (1978). Nesting ecology of the Plain Chachalaca in south Texas. *Wilson Bull.* 90(3):386-395.
- Marjakangas, A. (1980). [Snow roosting in tetraonids (Tetraonidae)]. *Mem. Soc. Fauna Flora Fenn.* 56:65-70. In Finnish with English summary.
- Marjakangas, A. (1986). On the winter ecology of the Black Grouse, *Tetrao tetrix*, in central Finland. *Acta Univ. Oulu A* 183, Biol. 29.
- Marjakangas, A. (1990). A suggested antipredator function for snow-roosting behaviour in the Black Grouse *Tetrao tetrix*. *Ornis Scand.* 21:77-78.
- Marjakangas, A. & Aspegren, H. (1991). Responses of Black Grouse *Tetrao tetrix* hens to supplemental winter food. *Ornis Scand.* 22:282-283.
- Marjakangas, A. & Moss, R. (1991). Workshop summary: The role of nutrition in population regulation of grouse. *Ornis Scand.* 22:295-296.
- Marjakangas, A., Rintamäki, H. & Hissa, R. (1984). Thermal responses in the Capercaillie (*Tetrao urogallus*) and the Black Grouse (*Lyrurus tetrix*) roosting in the snow. *Physiol. Zool.* 57:99-104.
- Markgren, G. & Markgren, M. (1960). On the Spotted Eagle and its occurrence in Sweden. *Vår Fågelvärld* 19:273-285.
- van Marle, J.G. & Voous, K.H. (1946). The endemic sparrowhawks of Celebes. *Limosa* 19:15-23.
- van Marle, J.G. & Voous, K.H. (1988). *The Birds of Sumatra*. BOU Checklist. British Ornithologists' Union, Tring, UK.
- Marquis, M. (1980). Using moult and iris colour to age sparrowhawks. *Ring. Bull.* 5:94-95.
- Marquis, M. & Newton, I. (1982a). A radiotracking study of the ranging behaviour and dispersion of European Sparrowhawks *Accipiter nisus*. *J. Appl. Ecol.* 51:111-133.
- Marquis, M. & Newton, I. (1982b). The Goshawk in Britain. *British Birds* 75(6):243-260.
- Marquis, M., Ratcliffe, D.A. & Roxburgh, R. (1985). The numbers, breeding success and diet of Golden Eagle in southern Scotland in relation to changes in land use. *Biol. Conserv.* 33:1-17.
- Marroquin, M.A.V. & Moreno, E.R. (1992). Nesting biology of the Roadside Hawk in Tikal National Park. Pp. 169-172 in: Whitacre & Thorstorn (1992).
- Marroquin, M.A.V., Moreno, E.R. & Ortiz, T.D. (1992). Nesting biology of three species of kites. Pp. 145-151 in: Whitacre & Thorstorn (1992).
- Marsden, H.M. & Baskett, T.S. (1958). Annual mortality in a banded Bobwhite population. *J. Wildl. Manage.* 22:414-419.
- Marshall, J.T. (1949). The endemic avifauna of Saipan, Tinian, Guam and Palau. *Condor* 51:200-221.
- Marshall, W.H. (1946). Cover preferences, seasonal movements and food habits of Richardson's Grouse and Ruffed Grouse in southern Idaho. *Wilson Bull.* 58:42-52.
- Marshall, W.H. (1965). Ruffed Grouse behavior. *BioScience* 15:92-94.
- Martella, M.B. & Bucher, E.H. (1984). Nesting of the Spot-winged Falconet in Monk Parakeet nests. *Auk* 101(4):614-615.
- Martella, M.B., Navarro, J.L. & Bucher, E.H. (1985). Vertebrates associated with Monk Parakeet (*Myiopsitta monachus*) nests in Córdoba and La Rioja, Argentina. *Physiol. (Sec. C)* 43(105):49-51.
- Martí, C. (1979). Zur Nahrungselektion von Hühnern und Hennen des Birkhuhns (*Tetrao tetrix* L.) in der Vorlegeperiode. Gymnasiallehrarbeit, Zoological Institute of Berna University.
- Martí, C. (1986). Situation énergétique du Tétrus-lyre en période d'hivernage. *Bull. mens. ONC* 99:12-15.
- Martí, C. & Bossert, A. (1985). Beobachtungen zur Sommeraktivität und Brutbiologie des Alpensechshuhns *Lagopus mutus* im Aletschgebiet (Wallis). *Orn. Beob.* 82:153-168.
- Martí, C. & Pauli, H.R. (1985). Wintergewicht, Masse und Altersbestimmung in einer alpinen Population des Birkhuhns *Tetrao tetrix*. *Orn. Beob.* 82:231-241.
- Martí, C.D. & Braun, C.E. (1975). Use of tundra habitats by Prairie Falcons in Colorado. *Condor* 77:213-214.
- Martin, A.C., Zim, H.S. & Nelson, A.L. (1951). *American Wildlife and Plants*. McGraw Hill and Co., New York.
- Martin, B.P. (1992). *Birds of Prey of the British Isles*. David & Charles, Newton Abbot, UK.
- Martin, J.W. (1986). *Behavior and Habitat Use of Breeding Northern Harriers in Southwestern Idaho*. MSc thesis, Brigham Young University, Provo, Utah.
- Martin, K. (1985). *The Utility of Bi-parental Care in Willow Ptarmigan: Ecological and Evolutionary Considerations*. PhD thesis, Queen's University, Kingston, Canada.
- Martin, K. (1989). Pairing and adoption of offspring by replacement male Willow Ptarmigan: behaviour, costs and consequences. *Anim. Behav.* 35:369-379.
- Martin, K. (1991). Experimental evaluation of age, body size, and experience in determining territory ownership in Willow Ptarmigan. *Can. J. Zool.* 69:1834-1841.
- Martin, K. (1992). Breeding behaviour of a pair of Whistling Kites *Haliastur sphenurus*. *Aust. Bird Watcher* 14:230-240.
- Martin, K. & Hannon, S.J. (1987). Naal philopatry and recruitment of Willow Ptarmigan in north central and northwestern Canada. *Oecologia* 71:518-524.
- Martin, K. & Hix, D. (1992). Willow Ptarmigan chicks consume moss sporophyte capsules. *J. Field. Orn.* 63:355-358.
- Martin, K., Hannon, S.J. & Lord, S. (1990). Female-female aggression in White-tailed Ptarmigan and Willow Ptarmigan during the pre-incubation period. *Wilson Bull.* 102:532-536.
- Martin, K., Hannon, S.J. & Rockwell, R.F. (1989). Clutch size variations and patterns of attrition in fecundity of Willow Ptarmigan. *Ecology* 70:1788-1799.
- Martin, N.S. (1970). Sagebrush control related to habitat and Sage Grouse occurrence. *J. Wildl. Manage.* 34:313-320.

- Mendoza, M. (1982a). Observaciones preliminares sobre alimentación de Perdiz Saharana (*Colinus cristatus*) en el Edo. Cojedes. *Acta Cient. Venez.* 33: 96.
- Mendoza, M. (1982b). Observaciones preliminares sobre actividad reproductiva de Perdiz Saharana (*Colinus cristatus*) en el Edo. Cojedes. *Acta Cient. Venez.* 33: 122.
- Meng, H.K. (1959). Food habits and nesting Cooper's Hawks and Goshawks in New York and Pennsylvania. *Wilson Bull.* 71: 169-174.
- Menoni, E. (1987). Éléments préliminaires de la dynamique de population du Grand Tétraz dans deux massifs des Pyrénées Centrales. *Acta Biologica Montana* 7: 73-82.
- Menoni, E., & Novoa, C. (1988a). The characteristics of two hunted populations of Capercaillie in the French Pyrenees. In: Lovel & Hudson (1988).
- Menoni, E., & Novoa, C. (1988b). Apport de l'analyse des tableaux de chasse dans la connaissance des populations de Grand Tétraz *Tetrao urugallus* L. *Gibier Faune Sauvage* 5: 255-272.
- Mentis, M.T. (1970). Swainson's Francolin. *Farmer's Weekly* (Apr.): 75.
- Mentis, M.T. (1973). *A Comparative Ecological Study of Greywing and Redwing Francolins in the Natal Drakensberg*. MSc thesis, University of Stellenbosch.
- Mentis, M.T. (1978). Principal foods of African Quail in southern and western Natal. *Limnigeryer* 24: 1-4.
- Mentis, M.T., & Bigalke, R.C. (1973). Management for Greywing and Redwing Francolins in Natal. *S. Afr. J. Wildl. Manage. Assoc.* 3: 41-47.
- Mentis, M.T., & Bigalke, R.C. (1979). Some effects of fire on two grassland francolins in the Natal Drakensberg. *S. Afr. J. Wildl. Res.* 9: 1-8.
- Mentis, M.T., & Bigalke, R.C. (1980). Breeding, social behaviour and management of Greywing and Redwing Francolins. *S. Afr. J. Wildl. Res.* 10: 133-139.
- Mentis, M.T., & Bigalke, R.C. (1981a). Ecological isolation in Greywing and Redwing Francolins. *Ostrich* 52: 84-97.
- Mentis, M.T., & Bigalke, R.C. (1981b). The effect of scale of burn on the densities of grassland francolins in the Natal Drakensberg. *Biol. Conserv.* 21: 247-261.
- Mentis, M.T., & Bigalke, R.C. (1985). Counting francolins in grassland. *S. Afr. J. Wildl. Res.*
- Mentis, M.T., & Little, R.M. (1992). Distribution and abundance of francolins in the Natal Drakensberg. *S. Afr. J. Wildl. Res.* 22: 70-75.
- Mentis, M.T., Poggendorf, B., & Maguire, R.R.K. (1975). Food of the Helmeted Guineafowl in highland Natal. *S. Afr. J. Wildl. Manage. Assoc.* 5: 23-26.
- Menzdorf, A. (1976a). Zur Ontogenese einiger Rufe beim Steinhuhn. *Zool. Anz.* 196: 221-36.
- Menzdorf, A. (1976b). Ausdrucksbewegungen beim Steinhuhn (*Alectoris graeca*). *Orn. Mitt.* 28: 29-36.
- Menzdorf, A. (1976c). Bemerkungen zum Hahnerwerb und zur Futterzusammensetzung bei Feldhühnern. *Vogelwelt* 97: 99-107.
- Menzdorf, A. (1977). [Contribution to the study of the vocalizations of the Chukar]. *Beitr. Vogelkd.* 23: 85-100. In German with English summary.
- Menzdorf, A. (1982). Social behaviour of Rock Partridges *Alectoris graeca*. *J. World Pheasant Assoc.* 7: 70-89.
- Mercer, W.E. (1967). *Ecology of an Island Population of Newfoundland Willow Ptarmigan*. Newfoundland and Labrador Wildlife Scientific Technical Bulletin 2.
- Meredith, P. (1990a). Encounters between Wedge-tailed Eagles and hang-gliders. *Austr. Bird Watcher* 13: 153-155.
- Meredith, P. (1990b). The Wedge-tailed Eagle, majestic symbol of our inland sky. *Austr. Geographic* 17: 60-79.
- Meretsky, V., & Snyder, N.F.R. (1992). Range use and movements of California Condors. *Condor* 94: 313-335.
- van der Merwe, F. (1981). Review of the status and biology of the Black Harrier *Circus maurus*. *Ostrich* 52: 193-207.
- van der Merwe, F. (1992). Booted Eagle foraging on ground. *Promemps* 204: 1-8.
- Meserve, P.L. (1977). Food habits of a White-tailed Kite population in central Chile. *Condor* 79(2): 263-265.
- Meslow, E.C. (1966). *The Drumming Log and Drumming Log Activity of Male Ruffed Grouse*. MSc thesis, University of Minnesota, Minneapolis.
- Metcalf, E.C. (1989). The breeding biology of the Australian Hobby *Falco longipennis*. *Austr. Bird Watcher* 13: 20-29.
- Metcalf, E.C., Ross, T., & Metcalf, R. (1989). Nest structure of the Collared Sparrowhawk *Accipiter cirrocephalus*. *Austr. Bird Watcher* 13: 32-34.
- Mey, E. (1990). Zur Taxonomie der auf Großfußhühnern (Megapodiidae) schwarztötenden *Oxylipeurus*-Arten (Insecta, Phthiraptera, Ischnocera: Lipeuridae). *Zool. Abh. Mus. Tierkd., Dresden* 46(6): 103-116.
- Meyburg, B.U. (1966). Beobachtungen über das Verhalten des Schwarzmilans (*Milvus migrans*). *Orn. Mitt.* 18: 239-245.
- Meyburg, B.U. (1967). Beobachtungen zur Brutbiologie des Schwarzen Milans (*Milvus migrans*). *Vogelwelt* 88: 70-85.
- Meyburg, B.U. (1968). Ein neuer Weg zum Schutze des Schreiadlers (*Aquila pomarina*). *Berliner Naturschutzbl.* 12: 287-293.
- Meyburg, B.U. (1970). Zur Biologie des Schreiadlers (*Aquila pomarina*). *Jb. Dt. Falkenorden* (1969): 32-66.
- Meyburg, B.U. (1971). Versuche zur künstlichen Steigerung der Vermehrungsrate des Schreiadlers (*Aquila pomarina*) zu seinem Schutze. *Beitr. Vogelk.* 17: 207-227.
- Meyburg, B.U. (1973). Studies of less familiar birds: 172 - Lesser Spotted Eagle. *British Birds* 66: 439-447.
- Meyburg, B.U. (1974a). Zur Brutbiologie und taxonomischen Stellung des Schreiadlers. *Falke* 21: 126-134, 166-171.
- Meyburg, B.U. (1974b). Sibling aggression and mortality among nestling eagles. *Ibis* 116: 224-228.
- Meyburg, B.U. (1974c). Quatre poussins dans un nid de l'Aigle Impérial d'Espagne (*Aquila heliaca adalberti*). *Alauda* 42: 1-9.
- Meyburg, B.U. (1975). On the biology of the Spanish Imperial Eagle (*Aquila heliaca adalberti*). *Ardeola* 21(Special Vol.): 245-283.
- Meyburg, B.U. (1976). Status, Bedrohung und Schutz der Greifvögel (Falconiformes) in Westspanien. *Angew. Orn.* 13: 35.
- Meyburg, B.U. (1978a). Sibling aggression and cross-fostering of eagles. Pp. 195-200 in: Temple, S.A. ed. (1978). *Endangered Birds Management. Techniques for Threatened Species*. University of Wisconsin Press, Madison.
- Meyburg, B.U. (1978b). Productivity manipulation in wild eagles. Pp. 81-93 in: Geer, T.A. ed. (1978). *Birds of Prey Management Techniques*. British Falconers' Club, Oxford.
- Meyburg, B.U. (1979a). *Survey of the Madagascar Sea Eagle Haliaeetus vociferoides*. Proposal submitted to IUCN/WFP/ICBP, 16 March.
- Meyburg, B.U. (1979b). *Survey of the Madagascar Serpent Eagle Eutriorchis astur*. Proposal submitted to IUCN/WFP/ICBP, 6 March.
- Meyburg, B.U. (1982). Seltene und vom Aussterben bedrohte Greifvögel (III). Der Spanische Kaiseradler *Aquila heliaca adalberti*. *Der Falkner* 31(32): 21-30.
- Meyburg, B.U. (1986). Threatened and near-threatened diurnal birds of prey of the world. Pp. 1-12 in: Chancellor & Meyburg (1986).
- Meyburg, B.U. (1987). Clutch size, nestling aggression and breeding success of the Spanish Imperial Eagle. *British Birds* 80: 308-320.
- Meyburg, B.U. (1989a). The Spanish Imperial Eagle *Aquila heliaca adalberti*: its biology, status and conservation. Pp. 255-268 in: Meyburg & Chancellor (1989).
- Meyburg, B.U. (1989b). Wild status of Old World Vulture species. Pp. 626-631 in: *Amer. Assoc. Zool. Parks Regional Conf. Proc.*
- Meyburg, B.U. (1991). Der Schreiadler (*Aquila pomarina*): Bisherige und zukünftige Bemühungen um seine Erhaltung und seinen Schutz. *Populationsök. Greifvögel u. Eulenarten* 2: 89-105.
- Meyburg, B.U., & Chancellor, R.D. eds. (1989). *Raptors in the Modern World*. Proceedings of the III World Conference on Birds of Prey and Owls. Eilat, Israel, 22-27 March 1987. World Working Group on Birds of Prey and Owls. Berlin, London & Paris.
- Meyburg, B.U., & Chancellor, R.D. eds. (1994a). *Raptor Conservation Today*. Proceedings of the IV World Conference on Birds of Prey and Owls. Berlin, 10-17 May 1992. Pica Press & World Working Group on Birds of Prey and Owls. Berlin, London & Paris.
- Meyburg, B.U., & Chancellor, R.D. eds. (1994b). *Eagle Studies*. World Working Group on Birds of Prey and Owls. Berlin, London & Paris.
- Meyburg, B.U., & Garzón, J. (1973). Sobre la protección del Águila Imperial Ibérica (*Aquila heliaca adalberti*) amenazado artificialmente la mortalidad juvenil. *Ardeola* 19: 107-128.
- Meyburg, B.U., & Loebke, E.G. (1994). Satellite-tracking of a juvenile Steller's Sea Eagle *Haliaeetus pelagicus*. *Ibis* 136(1): 105-106.
- Meyburg, B.U., & Meyburg, C. (1983). Vultures in Mongolia. Pp. 99-106 in: Wilbur & Jackson (1983).
- Meyburg, B.U., & Meyburg, C. (1984). Distribution et statut actuel des aigles du Vautour moine (*Aegypius monachus*). Pp. 26-31 in: *CRPR (1984) Rapaces Méditerranéennes II*. Centre de Recherches et Protection des Rapaces. Barcelona, Spain.
- Meyburg, B.U., & Meyburg, C. (1987). The Osprey as a breeding bird in central Europe (NP). *Bund* 27: 34-41.
- Meyburg, B.U., & Meyburg, C. (1988). Der Schreiadler (*Aquila pomarina*) als Hochgebirgsvogel im Kaukasus. *J. Orn.* 129: 102-105.
- Meyburg, B.U., & Meyburg, C. (1991). Acquisition of adult plumage in the Spanish Imperial Eagle *Aquila heliaca adalberti*. Pp. 225-258 in: Chancellor & Meyburg (1991).
- Meyburg, B.U., & Pielowski, Z. (1991). Cainism in the Greater Spotted Eagle *Aquila clanga*. Pp. 143-148 in: Chancellor & Meyburg (1991).
- Meyburg, B.U., van Balen, S., Thollay, J.M., & Meyburg, C. (1989). Observations on the Endangered Java Hawk Eagle *Spizienus bartelsi*. Pp. 279-300 in: Meyburg & Chancellor (1989).
- Meyburg, B.U., Haraszhly, L., Meyburg, C., & Vizi, L. (1994). Satelliten- und Bodentelemetrie bei einem jungen Kaiseradler (*Aquila heliaca*). Familienauflösung und Dispersion. In: Meyburg & Chancellor (1994b).
- Meyburg, B.U., Mizera, T., & Neumann, T. (1992). See- und Schreiadlertragung in Polen. *Orn. Mitt.* 44: 148-149.
- Meyburg, B.U., Mizera, T., Maciorowski, G., Dylawski, M., & Smyk, A. (1994). Juvenile Greater Spotted Eagle *Aquila clanga* falling victim to an Eagle Owl *Bubo bubo*. *British Birds* 87.
- Meyburg, B.U., Scheller, W., & Meyburg, C. (1993). Satelliten-Telemetrie bei einem juvenilen Schreiadler (*Aquila pomarina*) auf dem Herbstzug. *J. Orn.* 134: 173-179.
- Meyer de Schauensee, R. (1940). Rediscovery of the megapode *Aepyodius bruijnii*. *Auk* 57: 83-84.
- Meyer de Schauensee, R. (1964). *The Birds of Colombia and Adjacent Areas of South and Central America*. Livingston Publishing Co., Narberth, Pennsylvania.
- Meyer de Schauensee, R. (1982). *A Guide to the Birds of South America*. Livingston Press, Narberth, Pennsylvania.
- Meyer de Schauensee, R. (1984). *The Birds of China*. Smithsonian Institution Press, Washington, D.C.
- Meyer de Schauensee, R., & DuPont, J.E. (1962). Birds from the Philippine Islands. *Proc. Acad. Nat. Sci. Philadelphia* 114: 149-173.
- Meyer de Schauensee, R., & Phelps, W.H. (1978). *A Guide to the Birds of Venezuela*. Princeton University Press, Princeton, New Jersey.
- Meyer de Schauensee, R., & Ripley, S.D. (1940). *Zoological Results of the George Vanderbilt Sumatran Expedition, 1936-1939, Part I. Birds from Atjeh*. Proceedings of Natural Sciences of Philadelphia Vol. XCI, 1939.
- Meyer, H.F. (1971a). Shelley's Francolin. *Honeyguide* 66: 27-28.
- Meyer, H.F. (1971b). Notes on Coqui Francolin. *Honeyguide* 65: 29-30.
- Meyer, K.D. (1990). Kites. Pp. 38-49 in: Pendleton, B.G. ed. (1990). *Proceedings of the Southeast Raptor Management Symposium and Workshop*. National Wildlife Federation Technical Series 14, Washington, D.C.
- Meyer, P.O. (1930). Untersuchungen an der Eier von *Megapodius eremita*. *Orn. Monatsber.* 38: 1-5.
- Mian, A., & Wajid, M.M. (1990). Food of the Black-winged Kite *Elaanus caeruleus* in Southern Punjab, Pakistan. *Pak. J. Zool.* 22: 406-407.
- Micheev, A.V. (1948). *Beluga kuropatka* [the Willow Grouse]. Moscow, In Russian.
- Mitchell, C.S. (1962). Eastern Red-footed Kestrels. *Honeyguide* 37: 6-7.
- Miles, M.L. (1964). First records of the White-tailed Kite for El Salvador and Alabama. *Auk* 81: 229.
- Miller, A.H. (1952). Supplemental data on the tropical avifauna of the arid upper Magdalena Valley of Colombia. *Auk* 69: 450-457.
- Miller, A.H. (1963). Seasonal activity and ecology of the avifauna of an American equatorial cloud forest. *Univ. Calif. Publ. Zool.* 66: 1-78.
- Miller, B.W., & Tilson, R.L. (1985). Snail Kite kleptoparasitism of Limpkins. *Auk* 102(1): 170-171.
- Miller, G.R. (1968). Evidence for selective feeding on fertilized plots by Red Grouse, hares, and rabbits. *J. Wildl. Manage.* 32: 849-853.
- Miller, G.R., & Watson, A. (1978). Territories and the food plant of individual Red Grouse. I. Territory size, number of mates, and brood size compared with the abundance, production and diversity of heather. *J. Anim. Ecol.* 47: 293-305.
- Miller, G.R., Watson, A., & Jenkins, D. (1970). Responses of Red Grouse populations to experimental improvement of their food. Pp. 323-335 in: Watson, A. ed. (1970). *Animal Populations in Relation to their Food Resources*. Blackwell Scientific Publications, Oxford & Edinburgh.
- Miller, L.D. (1989). [Information on the Greater Spotted Eagle]. Page 61 in: [Rare animals and those needing protection]. Materials of the Red Data Book collection of scientific papers. Moscow, In Russian.
- Miller, L. (1940). A new Pleistocene turkey from Mexico. *Condor* 44: 283-284.
- Miller, L. (1943). Notes on the Mearns Quail. *Condor* 45: 104-109.
- Miller, W. De W. (1905). List of birds collected in southern Sinaloa, Mexico, by J. H. Batty during 1903-1904. *Bull. Amer. Mus. Nat. Hist.* 21: 339-369.
- Miller, W. De W., & Griscom, L. (1921a). Notes on *Ortalis vetula* and its allies. *Auk* 38: 44-50.
- Miller, W. De W., & Griscom, L. (1921b). The type locality of *Ortalis vetula* - a correction. *Auk* 38: 455.
- Miller, W.T. (1947). The Secretary Bird. *Afr. Wildl.* 1: 38-45.
- Millsap, B.A. (1981a). *Distributional Status of Falconiformes in West Central Arizona with Notes on Ecology, Reproductive Success, and Management*. US Bureau of Land Management Technical Note 355.
- Millsap, B.A. (1981b). *Zone-tailed Hawk (Buteo albonotatus)*. US Bureau of Land Management Technical Note 355.
- Millsap, B.A. (1986). *Biosystematics of the Gray Hawk, Buteo nitidus (Latham)*. MSc dissertation, George Mason University, Fairfax, Virginia.
- Millsap, B.A. (1987). Summer concentration of American Swallow-tailed Kites at Lake Okeechobee, Florida, with comments on post-breeding movements. *Florida Field Nat.* 15(4): 85-92.
- Milon, P., Petter, J.J., & Randrianasolo, G. (1973). *Faune de Madagascar*. Vol XXXV. Oiseaux. ORSTOM & CNRS, Tananarive & Paris.
- Milonoff, M., Hissa, R., & Silverin, B. (1992). The abnormal conduct of Capercaillies *Tetrao urugallus*. *Hormones and Behavior* 26: 556-567.
- Milstein, P.E.S., Olwagen, C.D., & Steyn, D.J. (1975). Field identification of the Bat Hawk. *Bokmakierie* 27: 12-14.
- Mindell, D.P. (1983). Harlan's Hawk, *Buteo jamaicensis harlani*, as valid subspecies. *Auk* 100: 161-167.
- Mindell, D.P., & White, C.M. (1988). Fluctuations of observed breeding Rough-legged Hawks and Gyrfalcons: regularity reconsidered. *Oecologia* 77: 14-18.
- Mingozzi, T. (1987). Revisione critica delle segnalazioni italiane di Poiana codabianca (*Buteo rufinus* Cr.). Pp. 155-168 in: Baccetti & Spagnesi (1987).
- Minneemann, D., & Busse, H. (1984). Beobachtungen und Bemerkungen zur Haltung und Zucht des Kuttengeiers *Aegypius monachus* L. im Tierpark Berlin. *Zool. Garten* 54: 439-453.
- Minoransky, V.A. (1962). [On the Steppe Eagle *Aquila rapax orientalis* L.]. *Zoologicheskii Zhurnal* 41: 295-296. In Russian.
- Miquet, A. (1990). Mortality in Black Grouse *Tetrao tetrix* due to elevated cables. *Biol. Conserv.* 54: 349-356.
- Miranda, H.C. (1991). The population status and foraging ecology of the Philippine Falconet *Micropodops erythronyx*. Unpublished report.
- Mironov, P.P. (1946). [Some questions of ecology of the Steppe Eagle of the northwestern Caspian Sea area in connection with relieving the lands from susliks]. *Tr. Rosnauk-na Donu n.-i. protivovann. in-ta* (Rostizdat) 5: 82-91. In Russian.
- Mirza, Z.B. (1980). Cheer Pheasant release programme in Pakistan. Pp. 72-75 in: Savage (1980).
- Mirza, Z.B., & Aleem, A., & Asghar, M. (1978). Pheasant surveys in Pakistan. *J. Bombay Nat. Hist. Soc.* 74: 292-296.
- Mishchenko, A.L. (1984). [Discovery of a nest of the Greater Spotted Eagle in the Moscow region]. *Ornitologiya* 19: 183. In Russian.
- Missbach, D. (1972). Die Brutplätze der Rohrweihe (*Circus aeruginosus*) im Bezirk Magdeburg. *Apus* 2: 232-245.
- Mitchell, L.C., & Millsap, B.A. (1990). Buteos and Golden Eagles. Pp. 50-62 in: *Proceedings of the Southwest Raptor Management Symposium and Workshop 1990*. National Wildlife Federation, Washington, D.C.
- Mitchell, M.H. (1957). *Observations on Birds of Southeastern Brazil*. University of Toronto Press, Toronto.
- Mitchev, T., & Petrov, T. (1979). [On the distribution of the Imperial Eagle (*Aquila heliaca* Savigny) in Bulgaria]. *Bull. Mus. S. Bulg.* 5: 65-77. In Bulgarian.
- Mizera, T., & Szymkiewicz, M. (1991). Trends, status and management of the White-tailed Sea Eagle *Haliaeetus albicollis* in Poland. Pp. 1-10 in: Chancellor & Meyburg (1991).
- Mocci, A. (1973). Recensement de la colonie de Faucon d'Eleanore *Falco eleonorae* de l'île de Sann Pietro (Sardaigne). *Alauda* 41: 385-402.
- Molesworth, B.D. (1955). A possible nesting association. *Malay. Nat. J.* 9: 116-118.
- Molinier, J.P., & Lapine, P. (1991). Gestion des forêts et conservation du Grand Tétraz: éléments de réflexion à partir d'observations en Forêt Domaniale du Castéra (Ariège, France). *Acta Biologica Montana* 10: 93-98.
- Müller, A.P. (1977). [Time of breeding, clutch size and nesting production in Buzzards *Buteo buteo* and Sparrowhawks *Accipiter nisus*, Goshawk *Accipiter gentilis* and Kestrel *Falco tinnunculus* in Northern Jutland, Denmark during the years 1960-1976]. *Minde meddelelser*. 67-68.
- Müller, A.P. (1987). Copulation behaviour in the Goshawk *Accipiter gentilis*. *Anim. Behav.* 35: 755-763.
- Müller, A.P. (1989). The Taita Falcon *Falco fasciatus*: results of a study at Mt Elgon. Pp. 315-319 in: Meyburg & Chancellor (1989).
- Murphy, D.E. (1933). L'abitudine dell' *Aquila clanga*. *Riv. ital. Orn.* 13: 97-100.
- Muroni, E., & Ruscone, G.G. (1940-1944). *Gli uccelli dell'Africa Orientale Italiana*. 4 Vols. Milan.

- Mondragón, J. & Baez, M. (1981). Actividades realizadas acerca de los crávidos de México en la región Chimalapa, Oaxaca. Pp. 101-110 in: Estudillo López (1981).
- Monk, J.F. ed. (1992). *Avian Systematics and Taxonomy*. Centenary Supplement (112A) of the Bulletin of the British Ornithologists' Club.
- Monneret, R.J. (1987). *Le Faucon Pelerin*. Editions du Point Veterin, Maisons-Alfort, France.
- Monroe, B.L. (1963). Three new subspecies of birds from Honduras. *Oreos. Papers Mus. Zool., Louisiana State Univ.* 136: 1-7.
- Monroe, B.L. (1968). *A Distributional Survey of the Birds of Honduras*. Ornithological Monographs 7. American Ornithologists' Union.
- Monroe, B.L. (1970). Effects of habitat changes on population levels of the avifauna in Honduras. Pp. 38-41 in: Buechner, H.K. & Buechner, J.H. eds. (1970). *The Avifauna of Northern Latin America, a Symposium held at the Smithsonian Institution, 13-15 April 1966*. Smithsonian Contributions Zoology 26.
- Monteiro, A.R. & de Mattos, G.T. (1984). Ocorrência de *Spizaeus ornatus ornatus* Daudin, 1801, gavião-de-penacho (Falconiformes: Accipitridae) em Viçosa, Minas Gerais. *Rev. Ceres* 31(176): 305-307.
- Montenegro, H.D.M., Montenegro, R.A.M., Echeverría, J.R.C., Alvarez, J.L.C., Rivera, M.C., Avila, W.E.M. & Caál, A.R. (1992). Behavior and breeding biology of the Ornate Hawk-eagle. Pp. 179-191 in: Whitacre & Thorstorn (1992).
- Montgomerie, R. & Thornhill, R. (1989). Fertility advertisement in birds: a means of inciting male-male competition? *Ethology* 81: 209-220.
- Montiel de la Garza, F. & Contreras-Balderas, A.J. (1990). First Hooked-billed Kite specimen from Nuevo León, Mexico. *Southwestern Naturalist* 35(3): 370.
- Mooney, N.J. (1976). *Selected Predatory and Social Behaviours of the Brown Falcon Falco berigora* tasmanica. M.A. thesis, University of Tasmania, Hobart.
- Mooney, N.J. (1988). Selection of mates and sexual dimorphism by size in the Brown Falcon *Falco berigora*. *Corella* 12: 124-126.
- Mooney, N.J. (1989). Co-operative hunting in the Brown Falcon *Falco berigora*. *Corella* 13: 18-21.
- Mooney, N.J. & Brothers, N.P. (1987). The Peregrine Falcon *Falco peregrinus macropus*, Swainson, in Tasmania. I. Distribution, abundance and physical characters of nests. *Austr. Wildl. Res.* 14: 81-93.
- Mooney, N.J. & Brothers, N.P. (1993). Dispersion, nest and pair fidelity of Peregrine Falcons in Tasmania. In: Olsen (1993a).
- Mooney, N.J. & Holdsworth, M. (1988). Observations of the use of habitat by the Grey Goshawk in Tasmania. *Tasmanian Bird Report* 17: 1-12.
- Moore, D.A. (1987). Ferruginous Hawk in Alberta. Pp. 193-197 in: Holroyd, G.L., McGillivray, W.B., Stepien, P.H., Ealey, D.M., Trotter, G.C. & Eberhart, K.E. eds. (1987). *Proceedings of the Workshop on Endangered Species in the Prairie Provinces*. Prov. Mus. Alberta Nat. Hist. Occ. Pap. 8.
- Moore, J. (1987). A survey of the breeding falcons of Esgalungmit Naunaat, West Greenland. *J. Raptor Res.* 21: 111-115.
- Moore, K.R. & Henny, C.J. (1983). Nest characteristics of three coexisting Accipiter hawks in northeastern Oregon. *J. Raptor Res.* 17(3): 65-76.
- Moore, N.W. (1957). The past and present status of the Buzzard in the British Isles. *British Birds* 50: 173-197.
- Moore, R.T. & Barr, A. (1941). Habits of the White-tailed Kite. *Auk* 58: 453-462.
- Moore, R.T. & Medina, D.R. (1957). The status of the chachalacas of western Mexico. *Condor* 59: 230-234.
- Morales, L.G. (1977a). *Contribución al estudio ecológico de la Perdiz Sabanera* (Colinus cristatus Gilliland). Trabajo Especial de Grado, Escuela Biología, Facultad de Ciencias, Universidad Central de Venezuela, Caracas.
- Morales, L.G. (1977b). Hábitos alimenticios de la Perdiz Sabanera (*Colinus cristatus barnesi* Gilliland). *Acta Cient. Venez.* 28: 44.
- Morales, L.G. (1980). Grupos de edad, hábitos alimentarios y ciclo reproductivo de la Perdiz Sabanera (*Colinus cristatus*, Aves, Galliformes) en el alto Apure, Venezuela. *Acta Biol. Venez.* 10: 215-239.
- Morales, L.G. & Pacheco, J. (1976). Aspectos ecológicos de *Colinus cristatus* en los módulos de Mantecal Estado Apure. *Acta Cient. Venez.* 27: 72.
- Morales-Pérez, J.E. & Navarro-Sigüenza, A.G. (1991). Distributional analysis of the birds of the northern highlands in Guerrero, Mexico. *Am. Inst. Biol. Univ. Mex. Auton. Mex. Ser. Zool.* 62(3): 497-510.
- Moreau, R.E. (1933). A note on the distribution of the Vulturine Fish-eagle *Gypohierax angolensis* Gmel. *J. Anim. Ecol.* 2: 179-183.
- Moreau, R.E. (1936). A contribution to the ornithology of Kilimanjaro and Mount Mene with the assistance in taxonomy by W. L. Slater. *Proc. Zool. Soc. London* (1936): 843-891.
- Moreau, R.E. (1945). On the Bateleur, especially at the nest. *Ibis* 87: 224-249.
- Moreau, R.E. (1963). The migration of the Quail. Pp. 374-375 in: Bannerman, D.A. (1963). *The Birds of the British Isles*. Vol. 12. Oliver & Boyd, Edinburgh.
- Moreau, R.E. (1969). The Sooty Falcon *Falco concolor* Temminck. *Bull. Brit. Orn. Club* 89: 62-67.
- Moreau, R.E. (1972). *The Palearctic-African Bird Migration Systems*. Academic Press, New York.
- Moreau, R.E. & Wayre, P. (1968). On the Palearctic quails. *Ardea* 56: 209-227.
- Morejohn, G.V. (1968a). Study of plumage of the four species of the genus *Gallus*. *Condor* 70: 56-65.
- Morejohn, G.V. (1968b). Breakdown of isolation mechanisms in two species of captive junglefowl. *Evolution* 22: 576-82.
- Morel, G.J. & Morel, M.Y. (1990). *Les Oiseaux de Sénégal*. Editions de l'Orstom, Paris.
- Morel, G.J. & Poulet, A.R. (1976). Un important dortoir d'*Elanus caeruleus*, Accipitridae, au Sénégal. *Oiseau et RFO* 46: 429-430.
- Morgan, A.D. (1979). Observations on immature fish eagles. *East Afr. Nat. Hist. Soc. Bull.* 19: 65-66.
- Morgan, A.H. (1948). White-tailed Kites roosting together. *Condor* 50: 92-93.
- Mori, S. (1980). Breeding biology of the White-tailed Eagle *Haliaeetus albicollis* in Hokkaido, Japan. *Tori* 29: 47-68.
- Morikawa, H. (1975). Toe extensors and flexors of Tibetan Snowcock. *Bull. Natl. Sci. Mus. (Ser. A, Zool.)* 1: 123-135.
- Morishika, M.Q. (1983). *Photographic Guide for Ageing Nestling Prairie Falcons*. US Bureau of Land Management, Boise, Idaho.
- Moritsch, M.G. (1985). *Photographic Guide for Ageing Nestling Ferruginous Hawks*. US Bureau of Land Management, Boise, Idaho.
- Moritz, D. & Vaak, G. (1976). Der Zug des Sperbers (*Accipiter nisus*) auf Helgoland. *J. Orn.* 117: 317-328.
- Morlokia, H. (1957). The Hainan Tree-partridge *Arborophila ardens*. *Ibis* 99: 334-6.
- Morris, D. (1951). The courtship of pheasants. *Zoo Life* 12: 8-13.
- Morris, E.T. (1976a). Plumage changes and moult pattern of the Brown Goshawk. *Emu* 76: 44-45.
- Morris, E.T. (1976b). Growth of plumage from chick to juvenile in the Wedge-tailed Eagle. *Emu* 76: 86.
- Morris, M.M.J. & Lemon, R.E. (1983). Characteristics of vegetation and topography near Red-shouldered Hawk nests in southwestern Quebec. *J. Wildl. Manage.* 47: 138-149.
- Morrison, J.A. & Lewis, J.C. (1972). *Proceedings of the First National Bobwhite Quail Symposium*. Oklahoma State University, Stillwater.
- Morrison, J.L. (1993). The elusive caracara: preliminary information from south central Florida. *J. Raptor Res.* 27(1): 77-78.
- Morrison, M.L. (1978). Breeding characteristics, egg-shell thinning, and population trends of White-tailed Hawks in Texas. *Bull. Texas Orn. Soc.* 11: 35-40.
- Mortensen, A., Nordoy, E.S. & Bliv, A.S. (1985). Seasonal changes in the body composition of the Norwegian Rink Ptarmigan *Lagopus mutus*. *Ornis Scand.* 16: 20-24.
- Mortensen, A., Unander, S., Kolstad, M. & Bliv, A.S. (1983). Seasonal changes in body composition and crop content of Spitzberg Ptarmigan *Lagopus mutus hyperboreus*. *Ornis Scand.* 14: 144-148.
- Morsan, R. & Dobehies, F. (1987). Comportements de l'Aigle de Bonelli (*Hieraetus fasciatus*) sur son site de nidification. *Oiseau et RFO* 57(2): 85-101.
- Mosher, J.A. (1989). Accipiters. Pp. 47-52 in: Pendleton, B.G. ed. (1989). *Proceedings of the Northeast Raptor Management Symposium and Workshop*. National Wildlife Federation Science Technical Series 13. Washington, D.C.
- Mosher, J.A. & Matray, P.E. (1974). Size dimorphism: a factor in energy savings for the Broad-winged Hawk. *Auk* 91: 325-341.
- Moss, D. (1979). Growth of nestlings Sparrowhawks (*Accipiter nisus*). *J. Zool., London* 187: 297-314.
- Moss, R. (1968). Food selection and nutrition in Ptarmigan (*Lagopus mutus*). *Symp. Zool. Soc. London* 21: 207-216.
- Moss, R. (1969). Rearing Red Grouse and Ptarmigan in captivity. *Avicult. Mag.* 75: 256-261.
- Moss, R. (1979). Social organization of Willow Ptarmigan in their breeding grounds in interior Alaska. *Condor* 74: 144-151.
- Moss, R. (1992b). Food selection by Red Grouse (*Lagopus lagopus scoticus*) in relation to chemical composition. *J. Anim. Ecol.* 61: 411-428.
- Moss, R. (1977). The digestion and intake of winter foods by a ptarmigan in Alaska. *Condor* 75: 203-214.
- Moss, R. (1974). Winter diets, gut lengths and interspecific competition in Alaskan ptarmigan. *Auk* 91: 737-746.
- Moss, R. (1980). Why are Capercillies so big? *British Birds* 73: 440-447.
- Moss, R. (1983). Gut size, body weight and digestion of winter foods by grouse and ptarmigan. *Condor* 85: 185-193.
- Moss, R. (1986). Rain, breeding success and distribution of Capercillie *Tetrao urogallus* and Black Grouse *Tetrao tetrix* in Scotland. *Ibis* 128: 65-72.
- Moss, R. & Hansen, I. (1980). Grouse nutrition. *Nutrition Abstracts and Reviews (Ser. B)* 50: 557-567.
- Moss, R. & Lockie, T. (1979). Intraspecific components in the song of the Capercillie *Tetrao urogallus*. *Ibis* 121: 95-97.
- Moss, R. & O'Swald, J. (1985). Population dynamics of Capercillie in a north-east Scottish glen. *Ornis Scand.* 16: 229-238.
- Moss, R. & Watson, A. (1980). Inherent changes in the aggressive behaviour of a fluctuating Red Grouse *Lagopus lagopus scoticus* Lath. population. *Ardea* 68: 114-119.
- Moss, R. & Watson, A. (1984). Maternal nutrition, egg quality and breeding success of Scottish Ptarmigan, *Lagopus lagopus scoticus*. *Ibis* 126: 212-220.
- Moss, R. & Watson, A. (1991a). Breeding success and movements as determinants of breeding density in tetraonid birds. *Congr. Internat. Union Game Biol.* 19.
- Moss, R. & Watson, A. (1991b). Population cycles and kin selection in Red Grouse *Lagopus lagopus scoticus*. *Ibis* 133: 113-120.
- Moss, R. & Weir, D.N. (1987). Demography of Capercillie in north-east Scotland. III. Production and recruitment of young. *Ornis Scand.* 18: 141-145.
- Moss, R., Trenholm, I.B., Watson, A. & Parr, R. (1990). Parasitism, predation and survival of hen Red Grouse *Lagopus lagopus scoticus* in spring. *J. Anim. Ecol.* 59: 631-642.
- Moss, R., Watson, A. & Parr, R. (1974). A role of nutrition in the population dynamics of some game birds (Tetraonidae). *Trans. Congr. Internat. Union Game Biol.* 14: 193-201.
- Moss, R., Watson, A. & Parr, R. (1975). Maternal nutrition and breeding success in Red Grouse (*Lagopus lagopus scoticus*). *J. Anim. Ecol.* 44: 233-244.
- Moss, R., Watson, A. & Rothery, P. (1984). Inherent changes in body size, viability and behaviour of a fluctuating Red Grouse (*Lagopus lagopus scoticus*) population. *J. Anim. Ecol.* 53: 171-189.
- Moss, R., Watson, A., Rothery, P. & Glennie, W.W. (1981). Clutch size, egg size, hatch and laying date in relation to early mortality in Red Grouse *Lagopus lagopus scoticus* chicks. *Ibis* 123: 450-462.
- Mossop, D.H. (1988a). A relation between aggressive behaviour and population dynamics in Blue Grouse. Pp. 4-28 in: Bergerud & Graston (1988b).
- Mossop, D.H. (1988b). Winter survival and breeding strategies of Willow Ptarmigan. Pp. 330-378 in: Bergerud & Graston (1988b).
- Mossop, D.H. & Hayes, R.D. (1982). The Yukon Territory Gyrfalcon harvest experiment (1974-80). Pp. 263-280 in: Ladd, W.N. & Schemp, P.E. eds. (1982). *Proceedings of a Symposium: Raptor Management and Biology in Alaska and Western Canada*. FWS/AK/PROC-82.
- Mossop, D.H. & Hayes, R.D. (1994). Long term trends in the breeding density and productivity of Gyrfalcon *Falco nestorius* in the Yukon Territory, Canada. In: Meyburg & Chancellor (1994a).
- Moulton, J.C. & Vanderschaeghen, P.V. (1974). *Bibliography of the Ruffed Grouse*. Wisconsin Department of Natural Resources, Madison.
- Mourer-Chauvire, C. & Cheneval, J. (1983). Les Sagittariidae fossiles (Aves, Accipitiformes) de l'Oligocène des Phosphorites du Quercy et du Miocène Inférieur de Saint-Gérard-le-Puy. *Géobios* 16: 443-459.
- Moyles, D.L.J. (1977). *A Study of Territory Establishment by and Movements of Male Sharp-tailed Grouse (Pedicocetes phasianellus) Relative to the Arena*. MSc. thesis, University of Alberta, Edmonton.
- Moyles, D.L.J. (1981). Seasonal and daily use of plant communities by Sharp-tailed Grouse (*Pediceetes phasianellus*) in the parklands of Alberta. *Can. Field-Nat.* 95: 287-291.
- Moyles, D.L.J. & Boag, D.A. (1981). Where, when and how male Sharp-tailed Grouse establish territories on arenas. *Can. J. Zool.* 59: 1576-1581.
- Mrlík, V. & Pavelka, J. (1994). A contribution to the knowledge of the territorial behaviour of the Imperial Eagle *Aquila heliaca*. In: Meyburg & Chancellor (1994b).
- Musya, C.A. (1993). Feeding habits of Crowned Eagles *Stephanoaethus coronatus* in Kiwengoma Forest Reserve, Matumbi Hills, Tanzania. Pp. 118-120 in: Wilson (1993).
- Mueller, H.C. (1972). Zone-tailed Hawk and Turkey Vulture: mimicry or aerodynamics? *Condor* 74(2): 221-222.
- Mueller, H.C. & Berger, D.D. (1967a). Fall migration of Sharp-shinned Hawks. *Wilson Bull.* 79: 397-415.
- Mueller, H.C. & Berger, D.D. (1967b). Some observations and comments on the periodic invasions of Goshawks. *Auk* 84: 183-191.
- Mueller, H.C. & Berger, D.D. (1968). Sex ratios and measurements of migrant Goshawks. *Auk* 85: 431-436.
- Mueller, H.C., Berger, D.D. & Allee, G. (1976). Age and sex variation in the size of Goshawks. *Bird Banding* 47: 310-318.
- Mueller, H.C., Berger, D.D. & Allee, G. (1977). The periodic invasions of goshawks. *Auk* 94: 652-663.
- Mueller, H.C., Berger, D.D. & Allee, G. (1979a). Age and sex differences in size of Sharp-shinned Hawks. *Bird Banding* 50: 34-44.
- Mueller, H.C., Berger, D.D. & Allee, G. (1979b). The identification of North American accipiters. *Amer. Birds* 33: 236-240.
- Mueller, H.C., Mueller, N.S. & Parker, P.G. (1981). Observations of a brood of Sharp-shinned Hawks in Ontario, with comments on the functions of sexual dimorphism. *Wilson Bull.* 93: 83-92.
- Muir, D. & Bird, D.M. (1984). Food of Gyrfalcons at a nest on Ellesmere Island. *Wilson Bull.* 96: 464-467.
- Mukherjee, A.K. (1966). The extinct and vanishing birds and mammals of India. *Bull. Ind. Mus.* 1: 7-41.
- Mukherjee, A.K. & Michael, R.G. (1993). Pheasant surveys in Meghalaya State, India. In: Jenkins (1993).
- Müller, F.J. (1979). A 15-year study of a Capercillie lek in the western Rhin Mountains (W. Germany). Pp. 120-130 in: Lovel (1979).
- Müller, J.P. (1988). *Der Bargeier*. Desertina Verlag, Disentis (Switzerland).
- Mullie, W.C., Brouwer, J. & Albert, C. (1992). Gregarious behaviour of African Swallow-tailed Kite *Chelictinia acrocoris* in response to high grasshopper densities near Quallan, western Niger. *Mulimbu* 14: 19-21.
- Mundt, J. & Uhlig, R. (1994). Bemerkenswerte Brutzeit-Ansammlungen von Schreiadlern *Aquila pomarina* im Weisbruch (Uckermark, Brandenburg). In: Meyburg & Chancellor (1994b).
- Mundy, P.J. (1978). The Egyptian Vulture (*Neophron percnopterus*) in Southern Africa. *Bird. Conserv.* 14: 307-315.
- Mundy, P.J. (1982). *The vulture of Southern African Vultures*. Vulture Study Group, Johannesburg.
- Mundy, P.J. (1983). The conservation of the Cape Griffon Vulture in southern Africa. Pp. 57-74 in: Wilbur & Jackson (1983).
- Mundy, P.J. (1985a). Sexual dimorphism of the African White-headed Vulture *Trigonocephalus occipitalis*. *Ibis* 127: 116-119.
- Mundy, P.J. (1985b). The biology of vultures: a summary of the working proceedings. Pp. 457-482 in: Newton & Chancellor (1985).
- Mundy, P.J. (1987). Notes on the White-headed Vulture. *Vulture News* 17: 11-15.
- Mundy, P.J. (1988). Some recent bird strikes on aeroplanes in Zimbabwe. *Honeyguide* 35: 66.
- Mundy, P.J. & Cook, A.W. (1972). Vultures. *Bull. Nigerian Orn. Soc.* 9: 8-9.
- Mundy, P.J. & Cook, A.W. (1975). Hatching and rearing of two chicks by the Hooded Vulture. *Ostrich* 46: 45-50.
- Mundy, P.J. & Ledger, J.A. (1976). Griffon Vultures, carnivores and bones. *S. Afr. J. Sci.* 72: 106-110.
- Mundy, P.J., Butchart, D., Ledger, J. & Piper, S. (1992). *The Vultures of Africa*. Academic Press, London.
- Mundy, P.J., Grant, K.L., Tannock, J. & Wessels, C.L. (1982). Pesticide residues and egg shell thickness of Griffon Vulture *Gyps coprotheres* in Southern Africa. *J. Wildl. Manage.* 46: 769-773.
- Mundy, P.J., Ledger, J.A. & Friedman, R. (1980). The Cape Vulture project in 1977 and 1978. *Bokmakiers* 32: 2-8.
- Munro, G.C. (1960). *Birds of Hawaii*. Charles E. Tuttle Co., Rutland, Vermont.
- Munro, N. (1993). A Kruger experience. *Wivaltersand Bird Club News Sheet* 160: 22-23.
- Murphy, D.A. & Baskett, T.S. (1952). Bobwhite mobility in central Missouri. *J. Wildl. Manage.* 16: 498-510.
- Murphy, J.R. (1974). Status of a Golden Eagle population in central Utah, 1967-1973. *Rap. Res. Rep.* 3: 91-96.
- Murphy, J.R. (1978). Management considerations for some western hawks. *Trans. North Amer. Wildl. Nat. Resour. Conf.* 43: 241-251.
- Murphy, R.C. (1955). Feeding habits of the Everglade Kite (*Rostrhamus sociabilis*). *Auk* 72: 204-205.
- Murphy, R.K., Graston, M.W. & Rosenfield, R.N. (1988). Activity and habitat use by a breeding male Cooper's Hawk in a suburban area. *J. Raptor Res.* 22: 97-100.
- Murphy, R.K. (1964). *Antecedent Sharp-shinned Hawk migration along the northeastern coast of the United States*. *Wilson Bull.* 76: 257-264.
- Murray, R.W. & Frye, E.O. (1957). The Bobwhite Quail and its management in Florida. *Flor. Game and Freshwater Fish Comm. Tech. Bull.* 4.
- Mussen, J.W. (1960). Blue Grouse: production, movements, and populations in the Boulder Mountains. Montana. *J. Wildl. Manage.* 24: 60-68.
- Mussen, J.W. (1963). Blue Grouse: brood cover selection and land use. *Montana J. Wildl. Manage.* 27: 346-355.
- Myrberget, S. (1970). Reproductive success of young and old Willow Ptarmigan, *Lagopus lagopus lagopus*, in north Norway. *Finnish Game Res.* 30: 169-172.
- Myrberget, S. (1972). Fluctuations in a north Norwegian population of Willow Grouse. Pp. 107-120 in: *Proc. XV Int. Orn. Congr.*, the Hague, 1970.

Myrberget / Nores

- Myrberget, S. (1974). Variations in the production of Willow Grouse *Lagopus lagopus* (L.) in Norway, 1963-1972. *Ornis Scand.* 5: 163-172.
- Myrberget, S. (1975). Age distribution, mortality and migration of Willow Grouse, *Lagopus lagopus* on Senja, north Norway. *Avibase* 8: 29-35.
- Myrberget, S. (1976). Hunting mortality, migration, and age composition of Norwegian Willow Grouse (*Lagopus lagopus*). *Norwegian J. Zool.* 24: 47-52.
- Myrberget, S. (1977). Size and shape of eggs of Willow Grouse. *Ornis Scand.* 8: 39-46.
- Myrberget, S. (1979). Winter food of Willow Grouse in two Norwegian areas. *Medd. Norsk Vilthorsk.* 3(7): 1-32.
- Myrberget, S. (1984). Population dynamics of Willow Grouse *Lagopus lagopus* on an island in north Norway. *Fauna Norvegica (Ser. C, Cinclus)* 7: 95-105.
- Myrberget, S. (1985). Is hunting mortality compensated for in grouse populations, with special reference to Willow Grouse? *Trans. Congr. Internat. Union Game Biol.* 17: 329-336.
- Myrberget, S. (1987). The effects of sheep grazing on a Willow Grouse breeding habitat. *Fauna, Oslo* 40: 144-149.
- Myrberget, S. (1988). Demography of an island population of Willow Ptarmigan in northern Norway. Pp. 379-419 in: Bergerud & Grønmo (1988b).
- Myrberget, S. (1989). Repeatability of clutch size in Willow Grouse *Lagopus lagopus lagopus*. *Ornis Scand.* 20: 74-76.
- Myrberget, S. & Skar, H.J. (1976). Fat and calorific content of Willow Grouse in autumn and winter. *Norwegian J. Zool.* 24: 41-45.
- Myrberget, S., Erikstad, K.E., Blom, R. & Spidsa, T.K. (1985). Estimation of nesting success and frequency of re-laying in Willow Grouse *Lagopus lagopus*. *Ornis Fenn.* 62: 9-12.
- Myrberget, S., Erikstad, K.E. & Spidsa, T.K. (1977). Variations from year to year in the growth rates of Willow Grouse chicks. *Astare* 10: 9-14.
- Nakagawa, H. & Fujimaki, Y. (1988). [Winter census of *Haliaeetus pelagicus* (Pall.) in Japan in 1986: the first international census]. Pp. 104-107 in: Litvinenko (1988). In Russian.
- Nakagawa, H., Lobkov, E.G. & Fujimaki, Y. (1987). Winter censuses on *Haliaeetus pelagicus* in Kamchatka and northern Japan in 1985. *Stria* 6: 14-19.
- Nankinov, D.N. (1982). [The Steppe Eagle (*Aquila nipalensis orientalis*) in southeastern Europe]. *Ornitologiya* 17: 137-142. In Russian.
- Nankinov, D.N. (1994). Distribution, migration and wintering of the Rough-legged Buzzard *Buteo lagopus* in Bulgaria. In: Meyburg & Chancellor (1994a).
- Naraj, R.K. (1985). Notes on some common breeding raptors of the Rajpipla forest. *J. Bombay Nat. Hist. Soc.* 82: 278-308.
- Naraj, R.K. (1991). Shikra *Accipiter badius* taking carrion. *J. Bombay Nat. Hist. Soc.* 88: 447-448.
- Naraj, R.K. & Monga, S.G. (1983). Observations of the Crested Serpent Eagle (*Spilornis cheela*) in Rajpipla Forests, south Gujarat. *J. Bombay Nat. Hist. Soc.* 80: 273-285.
- Narang, M.L. (1982). Searches for Western Tragopan in Himachal Pradesh, India, in 1987-89. Pp. 55-57 in: Jenkins (1993).
- Nardelli, P.M. (1981). La preservação do Pauil del nordeste brasileiro. Pp. 273-283 in: Estudillo López (1981).
- Nardelli, P.M. (1988). O "status" atual do mutum-do-nordeste brasileiro (*Mitu mitu*). Unpublished report presented at the II International Cracid Symposium, Caracas, Venezuela. February/March 1988.
- Nardelli, P.M. (1993). The Preservation of the *Alagus Curassow*. Zébo-botânica Mário Nardelli, Nílopolis, Rio de Janeiro.
- Narovsky, T. & Yuzieta, D. (1987). *Guía para la Identificación de las Aves de Argentina y Uruguay*. Vázquez Mazzini, Buenos Aires.
- Narovsky, T., Babarskas, M. & Lanus, B.J. (1992). Hallazgo del primer nido de Halconco Gris (*Spizopiterx circuncinctus*) en Buenos Aires. *Homero* 13(3): 246-247.
- Natorp, J.C. (1986). *Relations entre le Pastoralisme et les Populations de Vautours fauves (Gyps fulvus) sur le Versant Nord-Pyrénéen du Pays Basque (étude préliminaire)*. Thèse Vétérinaire, Nantes.
- Naumburg, W.W. (1930). *Birds of Mato Grosso*. Bulletin American Museum Natural History 60.
- de Naurais, R. (1981). Les Phasianides de l'île de São Tomé. *Cyanopica* 2(3): 29-36.
- Navas, J.R. & Bó, N.A. (1988). Aves nuevas o poco conocidas de Misiones, Argentina. II. *Com. Zool. Mus. Hist. Nat. Montevideo* 12(166): 1-9.
- Navas, J.R. & Bó, N.A. (1991). Aves nuevas o poco conocidas de Misiones, Argentina. IV. *Revista Mus. Arg. Cienc. Nat. B.R.* 15(8): 95-105.
- Naylor, B.J. (1989). *Adaptive Significance of Spring Territories of Female Spruce Grouse*. Dendragapus canadensis. PhD thesis, University of Toronto, Ontario.
- Naylor, B.J. & Bendell, J.F. (1987). Egg loss and nest site selection in Spruce Grouse. Pp. 272-283 in: *IV Int. Grouse Symposium*, Lam. West Germany.
- Naylor, B.J. & Bendell, J.F. (1989). Clutch size and egg size of Spruce Grouse in relation to spring diet, food supply, and endogenous reserves. *Can. J. Zool.* 67: 969-980.
- Naylor, B.J., Suzba, K.J. & Bendell, J.F. (1988). Nest cooling and recess length of incubating Spruce Grouse. *Condor* 90: 489-492.
- Nazarov, A.A. & Subnikova, O.N. (1971). [On the migrations of the Willow Grouse in the Autonomous Region of Jamal-Nenets]. *Bull. Mosk. obshchestva ispyt. prirody* 46: 22-30. In Russian.
- Neave, D.J. (1967). *The Population Dynamics of Ruffed Grouse (Bonasa umbellus L.) in central New Brunswick*. MSc thesis, University of New Brunswick, Fredericton.
- Neave, D.J. & Wright, B.S. (1969). The effects of weather and DDT spraying on a Ruffed Grouse population. *J. Wildl. Manage.* 33: 1015-1020.
- Nedraev, V.A. (1988). [Results of the winter census of the Steller's Sea Eagle on Sakhalin in 1986: the first international census]. Pp. 120-121 in: Litvinenko (1988). In Russian.
- Negi, I.S. (1992). Is the Mountain Quail extinct? *Ornithol.* 31: 1-2.
- Negret, A.J. (1987). Aves colombianas amenazadas de extinción. Primera aproximación. Anotaciones bibliográficas y observaciones personales. Unpublished report.
- Negret, A.J. (1991). Reportes recientes en el Parque Nacional Munchique de aves consideradas raras o amenazadas de extinción. *Novedades Colombianas* (nueva época) 2: 39-45.
- Negro, J.J. (1991a). Iniciativas para la conservación del Cernicalo Primilla en Andalucía. *Quercus* 59: 18-21.
- Negro, J.J. (1991b). *Ecología de Poblaciones del Cernicalo Primilla Falco naumanni*. PhD thesis, Universidad de Sevilla, Spain.
- Negro, J.J. & Hiraldo, F. (1992). Sex ratios in broods of the Lesser Kestrel *Falco naumanni*. *Ibis* 134(2): 190-191.
- Negro, J.J. & Hiraldo, F. (1993). Nest site selection and breeding success in the Lesser Kestrel *Falco naumanni*. *Bird Study* 40: 115-119.
- Negro, J.J. & Hiraldo, F. (1994). Lack of allozyme variation in the Spanish Imperial Eagle *Aquila adalberti*. *Ibis* 136(1): 87-90.
- Negro, J.J., Donazar, J.A. & Hiraldo, F. (1992). Copulatory behaviour in a colony of Lesser Kestrels: sperm competition and mixed reproductive strategies. *Anim. Behav.* 43: 921-930.
- Negro, J.J., Donazar, J.A. & Hiraldo, F. (1993). Home range of Lesser Kestrel (*Falco naumanni*) during the breeding season. Pp. 144-150 in: Nicholls & Clarke (1993).
- Negro, J.J., de la Riva, M. & Bustamante, J. (1991). Patterns of winter distribution and abundance of Lesser Kestrels (*Falco naumanni*) in Spain. *J. Raptor Res.* 25: 30-35.
- Nelson, E.W. (1932). A new subspecies of *Colinus nigricollis* (Gould). *Proc. Biol. Soc. Washington* 45: 169-172.
- Nelson, R.W. & Myres, T.M. (1976). Declines in populations of Peregrine Falcons and their seabird prey at Lanagora Island, British Columbia. *Condor* 78: 281-293.
- Nesbauer, M. (1991). 20 Jahre Schredderkontrolle einer Teilpopulation in Vorpommern. *Populationsök. Greifvögel - Eulenarten* 2: 137-140.
- Neufeldt, I.A. (1964). Notes on the nidification of the Pied Harrier *Circus melanoleucus* (Pennant), in Amurland. *USSR J. Bombay Nat. Hist. Soc.* 64: 284-306.
- Neumann (1933). [Races of *Penelope superciliosa*]. *Bull. Brit. Orn. Club* 55: 93-95.
- Newby, J.E. (1981). Notes on the Lanner *Falco biarmicus* from the Tenere Desert, with comments on the incidence of scorpion predation by raptors. *Mulumba* 3: 53.
- Newby-Varty, B.A. (1946). The Blue Quail *Oreortyx* 17: 371-372.
- Newgrain, K., Olsen, P.D., Green, B., Mooney, N.J., Brothers, N. & Bartos, R. (1993a). Food consumption rates of *Phasianus versicolor* in the Tenere Desert. In: Olsen (1993a).
- Newgrain, K., Green, B., Olsen, P.D., Brothers, N. & Mooney, N.J. & Bartos, R. (1993b). Validation of 22-sodium turnover for the estimation of food consumption and energy requirements of some captive Australian raptors. In: Olsen (1993a).
- Newman, K.B. (1999). Some notes on the feeding habits of the Lanner Geyser *Gypaetus barbatus*. *Bokmakierie* 21(4): 84-87.
- Newman, K.B. (1970). Display of male Secretary Bird *Watersnoot* and *Bird Club News Sheet* 69: 17.
- Newton, I. (1976). Breeding of Sparrowhawks (*Accipiter nisus*) in different environments. *J. Anim. Ecol.* 45: 831-849.
- Newton, I. (1978). Feeding and development of Sparrowhawk *Accipiter nisus*. *J. Zool., London* 184: 465-487.
- Newton, I. (1979). *Population Ecology of Raptors*. T. & A. D. Poyser, London.
- Newton, I. (1985a). Hawk. Pp. 273-276 in: Campbell & Luck (1985).
- Newton, I. (1985b). Lifetime reproductive output of female Sparrowhawks. *J. Anim. Ecol.* 54: 241-253.
- Newton, I. (1985c). Falcon. Pp. 202-203 in: Campbell & Luck (1985).
- Newton, I. (1986). *The Sparrowhawk*. T. & A. D. Poyser, Carlton.
- Newton, I. (1988). A key factor analysis of Sparrowhawk populations. *Oecologia* 76: 588-596.
- Newton, I. (1989). *Lifetime Reproduction in Birds*. Academic Press, London.
- Newton, I. (1991). Habitat variation and population regulation in Sparrowhawks. *Ibis* 133(Suppl. 1): 76-88.
- Newton, I. & Chancellor, R.D. (1985). *Conservation Studies on Raptors*. Proceedings of the II World Conference on Birds of Prey, Thessaloniki, Greece, April 1982. ICBP Technical Publication 5.
- Newton, I. & Haas, M.B. (1984). The return of the Sparrowhawk. *British Birds* 77: 47-70.
- Newton, I. & Haas, M.B. (1988). Pollutants in Merlin eggs and their effects on breeding. *British Birds* 81: 258-269.
- Newton, I. & Marquiss, M. (1976). Occupancy and success of nesting territories in the European Sparrowhawk. *J. Raptor Res.* 10: 65-71.
- Newton, I. & Marquiss, M. (1979). Sex ratio among nestlings of the European Sparrowhawk. *Amer. Naturalist* 113: 309-315.
- Newton, I. & Marquiss, M. (1981). Effect of additional food on laying dates and clutch sizes of Sparrowhawks. *Ornis Scand.* 12: 224-229.
- Newton, I. & Marquiss, M. (1982a). Eye colour, age and breeding performance in Sparrowhawks. *Bird Study* 29: 195-200.
- Newton, I. & Marquiss, M. (1982b). Fidelity to breeding area and mate in Sparrowhawks (*Accipiter nisus*). *J. Anim. Ecol.* 51: 327-341.
- Newton, I. & Marquiss, M. (1982c). Food, predation and breeding season in Sparrowhawks (*Accipiter nisus*). *J. Zool., London* 197: 221-240.
- Newton, I. & Marquiss, M. (1982d). Molt in the Sparrowhawk. *Ardea* 70: 163-172.
- Newton, I. & Marquiss, M. (1983). Dispersal of Sparrowhawks between birth place and breeding place. *Bird Study* 30: 30.
- Newton, I. & Marquiss, M. (1984). Seasonal trend in the breeding performance of Sparrowhawks. *J. Anim. Ecol.* 53: 809-829.
- Newton, I. & Marquiss, M. (1986). Population regulation in Sparrowhawks. *J. Anim. Ecol.* 55: 463-480.
- Newton, I. & Marquiss, M. (1991). Removal experiments and the limitation of breeding density in Sparrowhawks. *J. Anim. Ecol.* 60: 535-544.
- Newton, I. & Moss, D. (1986). Post-fledging survival of Sparrowhawks *Accipiter nisus* in relation to mass, brood size and brood composition at fledging. *Ibis* 128: 73-80.
- Newton, I. & Olsen, P.D. eds. (1990). *Birds of Prey*. Facts on File, Inc., New York.
- Newton, I., Bell, A. & Wyllie, I. (1981). Mortality of Sparrowhawks and Kestrels. *British Birds* 75: 195-204.
- Newton, I., Davis, P.E. & Davis, J.E. (1982). Ravens and Buzzards in relation to sheep-farming and forestry in Wales. *J. Appl. Ecol.* 19: 681-706.
- Newton, I., Davis, P.E. & Moss, D. (1981). Distribution and breeding of Red Kites in relation to land-use in Wales. *J. Appl. Ecol.* 18: 173-186.
- Newton, I., Marquiss, M. & Moss, D. (1979). Habitat, female age, organo-chlorine compounds and breeding of European Sparrowhawk. *J. Appl. Ecol.* 16: 777-793.
- Newton, I., Marquiss, M. & Moss, D. (1981). Age and breeding in Sparrowhawks. *J. Anim. Ecol.* 50: 839-853.
- Newton, I., Marquiss, M. & Rothery, P. (1983). Age structure and survival in a Sparrowhawk population. *J. Anim. Ecol.* 52: 591-602.
- Newton, I., Marquiss, M. & Village, A. (1983). Weights, breeding and survival in European Sparrowhawks. *Auk* 100: 344-354.
- Newton, S.F. & Shobrak, M. (1993). The Lappet-face Vulture *Torgos tracheliotus* in Saudi Arabia. Pp. 111-117 in: Wilson (1993).
- Nguyen Cu & Eames, J.C. (1993). The distribution and status of pheasants in Vietnam. Pp. 20-27 in: Jenkins (1993).
- Nicéforo María, H. (1955). Una crávida nueva para la avifauna colombiana. *Caldasia* 7: 177-184.
- Nicéforo María, H. & Olivares, A. (1965). Adiciones a la avifauna colombiana. II (Cracidae-Rynchopidae). *Bol. Soc. Venez. Cienc. Nat.* 26: 36-58.
- Nichol, W. (1963). Observations on the nesting of the South African Marsh Harrier. *Bokmakierie* 14: 32-34.
- Nicholls, M.K. & Clarke, R. eds. (1993). *Biology and Conservation of Small Falcons*. Proceedings of the 1991 Hawk & Owl Trust Conference, September 1991, Canterbury. The Hawk & Owl Trust, London.
- Nichols, J.D., Hensler, G.L. & Sykes, P.W. (1980). Demography of the Everglade Kite: implications for population management. *Ecol. Modeling* 9(3): 215-232.
- Nicholson, J.D. (1926). Nesting habits of the Everglade Kite in Florida. *Auk* 43: 62-67.
- Nicoll, M.E. & Langrand, O. (1989). *Madagascar: revue de la conservation des aires protégées*. WWF, Gland.
- Nieboer, E. (1973). *Geographical and Ecological Differentiation in the Genus Circus*. PhD dissertation, Free University, Amsterdam, Netherlands.
- Niederlechner, J.F. (1987). Use of early successional, mid-successional, and old-growth forests by breeding Blue Grouse (*Dendragapus obscurus fuliginosus*) on Hardwicke Island, British Columbia. *Can. J. Zool.* 65: 151-155.
- van Niekerk, J.H. (1979). Social and breeding behaviour of Crowned Guinea-fowl in the Krugersdorp Game Reserve. *Ostrich* 50: 188-189.
- van Niekerk, J.H. (1980). Some socio-biological features of Crowned Guinea-fowl in the Krugersdorp Game Reserve. *Bokmakierie* 32(4): 102-108.
- van Niekerk, J.H. (1983). Observations on courtship in Swainson's Francolin. *Bokmakierie* 35: 90-92.
- van Niekerk, J.H. (1985). Submissive display in young Helmeted Guinea-fowl. *S. Afr. J. Zool.* 20(1): 38.
- Nielsen, B.P. (1983). [Migratory behaviour and dispersal of Danish Kestrels *Falco tinnunculus*]. *Dan. Orn. Foren. Tidsskr.* 77: 1-12. In Danish.
- Nielsen, B.P. & Christensen, S. (1969). On the autumn migration of Spotted Eagles and buzzards in the Middle East. *Ibis* 111: 620-621.
- Nielsen, O.K. (1986). *Population Ecology of the Gyrfalcon in Iceland, with Comparative Notes on the Merlin and the Raven*. PhD thesis, Cornell University, Ithaca, New York.
- Nielsen, O.K. (1991). Kynroskauldur og athagatryggo falka. *Natturlifraeingurinn* 60: 135-143.
- Nielsen, O.K. & Cade, T.J. (1990a). Annual cycle of the Gyrfalcon in Iceland. *Natl. Geogr. Res.* 6: 41-62.
- Nielsen, O.K. & Cade, T.J. (1990b). Seasonal changes in food habits of Gyrfalcons in NE Iceland. *Ornis Scand.* 21: 202-211.
- Nielsen, O.K. & Petrusson, G. (1993). Population fluctuations of Gyrfalcons and Rock Ptarmigan: analysis of export figures from Iceland. *Oecologia*.
- Niemelä, E. (1974). Observations on nesting and brood rearing habitats of the Willow Grouse, *Lagopus lagopus*, in central Sweden. *Suomen Riista* 25: 97-105.
- Niethammer, G. (1942). *Handbuch der Deutschen Vögelkunde*. Vol. 3, Leipzig.
- Niethammer, G. (1958). Das Schicksal der Schottischen Moorschnephuhs auf dem europäischen Festland. *Anz. orn. Ges. Bayern* 5: 142-148.
- Niewold, F.J.J. (1982). Hypotheses on the cause of the decline in the Black Grouse populations in the Netherlands. Pp. 107-116 in: *Proc. 2nd Int. Symp. Grouse*.
- Niewold, F.J.J. & Nijland, H. (1987). Die Chancen des westeuropäischen Moor- und Heidebirkhuhs. *Zeit. Jagdwiss.* 33: 227-241.
- Nikiforov, E. (1992). Size and mobility of Grey Partridge *Pedix penix* winter coveys in Belorussia. Pp. 447-453 in: Birkan, Potts et al. (1992).
- Nikitina, Ye.Yu. (1991). [On the biology of the Imperial Eagle in the Central Caucasus]. Pp. 119-120 in: *Materials of the 10th All-union Orn. Conf.* Book 2, Part 2, Minsk, Nauka i tekhnika. In Russian.
- Nikolaus, G. (1987). *Distribution Atlas of Sudan's Birds with Notes on Habitat and Status*. Bonner zoologische Monographien 25. *Zoogeographisches Forschungsinstitut und Museum Alexander Koenig, Bonn*.
- Nikol'sev, A.P. (1967). [Data on the densities and hunting utilization of the Black Grouse in the USSR]. *Trudy Vsesoyuzn. Inst. zhivotnoy syr'ya i puxiny (Kirov)* 21: 114-197. In Russian.
- Nishide, T. (1979). Breeding records of Eastern Marsh Harrier *Circus aeruginosus japonicus* in the Hachigata reclaimed land, Akita Prefecture. *J. Yamashina Inst. Orn.* 11(2): 31-42.
- Nisbet, D.G. & Elliott, J.E. (1990). Levels of contaminants in Canadian raptors, 1966 to 1988: effects and temporal trends. *Can. Field-Nat.* 104: 222-243.
- Noer, H. & Secher, H. (1983). Survival of Danish Kestrels *Falco tinnunculus* in relation to protection of birds of prey. *Ornis Scand.* 14: 104-114.
- Nogué, G. (1982). *Le Vautour fauve, sa reproduction dans la Réserve Naturelle d'Ossau, et son alimentation*. Publ. Parc National des Pyrénées occidentales.
- Nogueira Neto, P. (1973). *A Criação de Animais Indígenas Vertebrados*. São Paulo.
- Norapueck, S. (1987). Thailand's rarest pheasant *Lophura nycthemera lewisi*. Pp. 102-105 in: Savage & Ridley (1987).
- Nores, M. & Yuzieta, D. (1980). *Aves de ambientes acústicos de Córdoba y centro de Argentina*. Secretaría de Estado de Agricultura y Ganadería, Provincia de Córdoba, Córdoba, Argentina.

- Nores, M. & Yzurieta, D. (1988). Situación y conservación de los crácidos de Argentina. Unpublished report presented at the II International Cracid Symposium, Caracas, Venezuela, February/March 1988.
- Nores, M., Yzurieta, D. & Miatello, R. (1983). Lista y distribución de las aves de Córdoba, Argentina. *Acad. Nat. Cienc. Córdoba* 56.
- Norgarh, C. & Lushrey, J. (1953). Jackal Buzzards. *Ostrich* 24: 33-36.
- North, M.E.W. (1944). Some East African birds of prey. *Ibis* 86: 117-138.
- North, M.E.W. (1947). Breeding of the Egyptian Vulture in Kenya Colony. *Ibis* 89: 662-663.
- North, M.E.W. (1948). The Lammergeyer in Kenya Colony. *Ibis* 90: 138-141.
- Nösel, H. (1992). Grey Partridge *Perdix perdix* population dynamics in East Germany. Pp. 351-357 in: Birkan, Potts & Esen (1992).
- Novaes, F.C. (1978). Sobre algumas aves pouco conhecidas da Amazonia brasileira II. *Bol. Mus. Para. Emílio Goeldi (Zool.)* 90.
- Novaes, C. (1992a). Comportement vocal printanier de la Perdrix grise des Pyrénées, (*Perdix perdix hispaniensis*), en réponse à des appels pré-enregistrés. *Gibier Faune Sauvage* 9(Mar.): 53-69.
- Novaes, C. (1992b). Validation d'un indice de la densité printanière des perdrix grises des Pyrénées, *Perdix perdix hispaniensis*, obtenu à l'aide d'appels pré-enregistrés. *Gibier Faune Sauvage* 9(Jun.): 105-118.
- Nugent, D.P. & Boag, D.A. (1982). Communication among territorial female Spruce Grouse. *Can. J. Zool.* 60: 2624-2632.
- Nugent, P.E., Escobar, J., Conrad, E. & Walters, C.E. (1989). Swallow-tailed Kites capture a bat and rough green snakes. *Condor* 53(4): 91-92.
- O'Brien, T.G., Pollock, K.H., Davidson, W.R. & Kellogg, F.E. (1985). A comparison of capture-recapture with capture-removal for quail populations. *J. Wildl. Manage.* 49: 1062-1065.
- O'Connor, R. (1982). Habitat occupancy and regulation of clutch size in the European Kestrel *Falco tinnunculus*. *Bird Study* 29: 17-26.
- O'Neill, J.P. (1974). *The Birds of Balsa, a Peruvian Dry Tropical Forest Locality, with an Analysis of their Origins and Ecological Relationships*. PhD thesis, Louisiana State University, Baton Rouge.
- O'Neill, J.P. (1978). Peru's White-winged Guan rediscovered. *Fauna, WWF Spec. Rept.* 1(1), Reprinted in *Birding* 11: 134.
- O'Neill, J.P. (1991). The Cracidae - an overview. *AAZPA 1991 Regional Proceedings*: 221-223.
- O'Neill, J.P. & Pearson, D.L. (1974). Estudio preliminar de las aves de Yarinacocha, Departamento de Loreto. *Perú. Publ. Mus. Hist. Nat. Javier Prado (Ser. A. Zool.)* 25: 1-13.
- O'Neill, J.P., del Solar, G., Ortiz, E., Elley, W. & Williams, M. (1981). The White-winged Guan, *Penelope albigularis*, its rediscovery, status, nesting, systematics and recommendations for its continued survival. Pp. 203-215 in: Estudillo López (1981).
- O'Reilly, P. & Hannon, S.J. (1989). Predation on simulated Willow Ptarmigan nests: the influence of density and cover on spatial and temporal patterns of predation. *Can. J. Zool.* 67: 1263-1267.
- Oakes, E.J. (1992). Lekking and the evolution of sexual dimorphism in birds: comparative approaches. *Amer. Naturalist* 140: 665-684.
- Oates, R.M. & Crawford, J.A. (1983). Effects of habitat manipulation on California Quail in western Oregon. *J. Wildl. Manage.* 47: 229-233.
- Oberholser, H.C. (1974). *The Bird Life of Texas*. Vol. 1, University of Texas Press, Austin, Texas.
- Ocampo, C. (1981). Aspectos generales sobre las crácidas en Colombia. Pp. 156-161 in: Estudillo López (1981).
- Odjög, T. & Sundell, J. (1976). Reproductive success of Ospreys in southern and central Sweden. *Ornis Scand.* 7: 71-84.
- Ogasawara, K. (1969). Winter habitats and food habits of the Green and Copper Pheasants. *Misc. Rep. Yamashina Inst. Orn.* 5(4): 351-63. In Japanese with English summary.
- Ogden, J.C. (1974). The Short-tailed Hawk in Florida. *Auk* 91(1): 95-110.
- Ogden, J.C. (1975). Effects of Bald Eagle territoriality on nesting Ospreys. *Wilson Bull.* 87: 496-505.
- Ogden, V.T. & Hornocker, M.G. (1977). Nesting density and success of Prairie Falcons in south-western Idaho. *J. Wildl. Manage.* 41: 1-11.
- Ogilvie, L.S. (1949). Nesting habits and early life of the Crested Green Wood Quail. *Malay. Nat. J.* 4: 80-84.
- Ogilvie-Grant, W.R. (1896-1897). *A Handbook to the Game-birds*. 2 Vols. Edward Lloyd, London.
- Ogurli, I. (1993). The status of the Ring-necked Pheasant in Turkey. Pp. 152-153 in: Jenkins (1993).
- Olech, B. (1991). [Protection of birds of prey in the Kampinos National Park (Poland): present state and indications]. *Ornitho. Przewod.* 49(1): 65-80. In Polish with English summary.
- Olendorff, R.R. (1973). *Ecology of the Nesting Birds of Prey of Northeastern Colorado*. US Inter. Biol. Program, Grassland Biome, Fort Collins, Colorado, Tech. Rep. 211.
- Olendorff, R.R. (1975). *Golden Eagle Country*. Alfred A. Knopf, New York.
- Olendorff, R.R. (1993). *Status, Biology and Management of Ferruginous Hawks: a review*. Raptor Res. and Tech. Assn. Center Occas. Pap. 1, US Bureau of Land Management, Boise, Idaho.
- Oliphant, L.W. (1985). North American Merlin breeding survey. *J. Raptor Res.* 19: 37-41.
- Oliphant, L.W. & Haug, E.A. (1985). Productivity, population density, and rate of increase in an expanding Merlin population. *J. Raptor Res.* 19: 56-59.
- Oliveras, A. (1957). Aves de las Costa del Pacifico, Municipio de Guapi, Cauca Colombia II. *Caldasia* 8: 33-93.
- Oliveras, A. (1969). *Aves de Cundinamarca*. Universidad Nacional de Colombia, Bogotá.
- Oliveras, A. & Hernández, J. (1962). Aves de la Comisaría del Vaupés (Colombia). *Rev. Biol. Trop., Univ. Costa Rica* 10: 61-90.
- de Oliveira, R.G. (1982). O Jacutinga (*Pipile jacutinga*) no Rio Grande do Sul. *An. Soc. Sul-Riogrand. Orn.* 3: 16-19.
- Oliver, W.R.B. (1955). *New Zealand Birds*. 2nd. edition. A. H. & A. H. Reed, Wellington.
- Olson, M. (1971). Salvin's Curassow. *Game Breeders Gazette* 9-10.
- Olson, M. (1976). Curassows. *J. World Pheasant Assoc.* 1: 105-108.
- Olmos, F. (1990a). Harrier-like hunting behavior by a Crane Hawk *Geranospiza caerulescens*. *Bull. Brit. Orn. Club* 110(4): 225-226.
- Olmos, F. (1990b). Nest predation of Plumbeous Ibis by capuchin monkeys and Greater Black Hawk. *Wilson Bull.* 102(1): 169-170.
- Olney, P.J. (1990). Studbooks, their history, organisation and uses. Pp. 240-245 in: Hill *et al.* (1990).
- Olrog, C.C. (1949). La avifauna del Aconquija. *Acta Zool. Lilloana* 7: 139-159.
- Olrog, C.C. (1960). *Penelope montani* en la Argentina (Aves, Galliformes). *Neotropica* 6: 58-59.
- Olrog, C.C. (1962). Notas ornitológicas sobre la colección del Instituto Miguel Lillo (Tucumán). VI. *Acta Zool. Lilloana* 28: 111-120.
- Olrog, C.C. (1979). Alarmanie escasez de rapaces en el sur argentino. *Hornero* 12: 82-84.
- Olrog, C.C. (1984). *Las Aves Argentinas*. Administración de Parques Nacionales, Buenos Aires.
- Olrog, C.C. (1985). Status of wet forest raptors in northern Argentina. Pp. 191-197 in: Newton & Chancellor (1985).
- Olsen, J. & Georges, A. (1993). Do Peregrine Falcon fledglings reach independence during peak abundance of their main prey? *J. Raptor Res.* 27: 149-153.
- Olsen, J. & Olsen, P.D. (1980). Alleviating the impact of human disturbance on the breeding Peregrine Falcon. II. Public and recreational lands. *Corella* 4: 54-57.
- Olsen, J. & Olsen, P.D. (1981). Natural breeding of *Accipiter fasciatus* in captivity, with notes on the release of young. *J. Raptor Res.* 15: 53-57.
- Olsen, J., Olsen, P.D., Billett, T. & Jolly, J. (1993). Observations on the breeding diet of the Peregrine Falcon in South Australia. In: Olsen (1993a).
- Olsen, M.W. (1960). Nine year summary of parthenogenesis in turkeys. *Proc. Soc. Exper. Biol. & Med.* 105(2): 279-281.
- Olsen, M.W. (1961). Surprising development: the chicken-turkey hybrid. *Agriculture Research* 9(7): 10.
- Olsen, P.D. (1982). Ecogeographic and temporal variation in the eggs and nests of the Peregrine, *Falco peregrinus* (Aves: Falconidae), in Australia. *Aust. Wildl. Res.* 9: 277-291.
- Olsen, P.D. (1991). *Aspects of the Evolutionary Ecology of Reproduction of Raptors*. PhD thesis, Australian National University, Canberra.
- Olsen, P.D. ed. (1993a). *Australian Raptor Studies*. Australasian Raptor Association, RAOA, Melbourne.
- Olsen, P.D. ed. (1993b). *Birds of Prey of Australia*. Australian Museum and Angus & Robertson, Sydney.
- Olsen, P.D. & Cockburn, A. (1991). Female-biased sex allocation in Peregrine Falcons and other raptors. *Behav. Ecol. Sociobiol.* 28: 417-423.
- Olsen, P.D. & Cockburn, A. (1993). Do large females lay small eggs? Sexual dimorphism and the allometry of egg and clutch volume. *Oikos* 66: 347-357.
- Olsen, P.D. & Marples, T.G. (1992). Alteration of the clutch size of raptors in response to a change in prey availability: evidence from control of a broad-scale rabbit infestation. *Wildl. Res.* 19: 129-135, 507.
- Olsen, P.D. & Marples, T.G. (1993). Geographical variation in egg and clutch size and rate of growth of Australian raptors (Falconiformes and Strigiformes). *Emu* 93: 167-179.
- Olsen, P.D. & Olsen, J. (1978). Alleviating the impact of human disturbance on the breeding Peregrine Falcon. I. Ornithologists. *Corella* 2: 1-7.
- Olsen, P.D. & Olsen, J. (1979). Eggshell thinning in the Peregrine, *Falco peregrinus* (Aves, Falconidae), in Australia. *Aust. Wildl. Res.* 6: 217-236.
- Olsen, P.D. & Olsen, J. (1980a). Observations on defence of the nest against humans by Australian species of *Falco*. *Emu* 80: 163-165.
- Olsen, P.D. & Olsen, J. (1980b). Observations on development, nesting chronology, and clutch and brood size in the Australian Kestrel, *Falco tinnunculus* (Aves, Falconidae). *Aust. Wildl. Res.* 7: 247-255.
- Olsen, P.D. & Olsen, J. (1985). A natural hybridization of the Brown Goshawk *Accipiter fasciatus* and Grey Goshawk *Accipiter novaehollandiae* in Australia, and a comparison of the two species. *Emu* 85: 250-256.
- Olsen, P.D. & Olsen, J. (1986). Distribution, status, movements and breeding of the Grey Falcon *Falco hypoleucos*. *Emu* 86: 47-51.
- Olsen, P.D. & Olsen, J. (1987a). Estimating the age of nestling raptors. *Aust. Bird Watcher* 12: 130-131.
- Olsen, P.D. & Olsen, J. (1987b). Movements and migration of the Australian Kestrel, *Falco tinnunculus*. *Falco* 87: 35-41.
- Olsen, P.D. & Olsen, J. (1987c). Egg weight loss during incubation in captive Australian Kestrels *Falco tinnunculus* and Brown Goshawks *Accipiter fasciatus*. *Emu* 87: 196-199.
- Olsen, P.D. & Olsen, J. (1988). Breeding of the Peregrine Falcon *Falco peregrinus*. I. Weather, nest, spacing and territory occupancy. *Emu* 88: 195-201.
- Olsen, P.D. & Olsen, J. (1989a). Breeding of the Peregrine Falcon *Falco peregrinus*. II. Weather, nest quality and the timing of laying. *Emu* 89: 1-5.
- Olsen, P.D. & Olsen, J. (1989b). Breeding of the Peregrine Falcon *Falco peregrinus*. III. Weather, nest quality and breeding success. *Emu* 89: 6-14.
- Olsen, P.D. & Peakall, D.B. (1983). DDE in eggs of the Peregrine Falcon in Australia 1949-1977. *Emu* 83: 276-277.
- Olsen, P.D., Crome, F. & Olsen, J. (1993). *Birds of Prey and Ground Birds of Australia*. Australian Museum and Angus & Robertson, Sydney.
- Olsen, P.D., Debus, S.J.S., Czechura, G.V. & Mooney, N.J. (1990). Comparative feeding ecology of the Grey Goshawk *Accipiter novaehollandiae* and Brown Goshawk *Accipiter fasciatus*. *Aust. Bird Watcher* 13: 178-192.
- Olsen, P.D., Emison, B., Mooney, N. & Brothers, N. (1992). DDT and dieldrin: effects on resident Peregrine Falcons in south-eastern Australia. *Ecotoxicology* 1: 89-100.
- Olsen, P.D., Fuller, P. & Marples, T.G. (1993). Pesticide-related eggshell thinning in Australian raptors. *Emu* 93: 1-11.
- Olsen, P.D., Marshall, R.C. & Gaud, A. (1989). Relationships within the genus *Falco*: a comparison of the electrophoretic patterns of feather proteins. *Emu* 89: 193-203.
- Olsen, P.D., Olsen, J. & Mooney, N.J. (1982). Growth and development of nestling Brown Goshawks *Accipiter fasciatus*, with details of breeding biology. *Emu* 82: 189-194.
- Olsen, P.D., Ross, T. & Olsen, J. (1987). Vestigial wing claws in Australian birds of prey. *Aust. Bird Watcher* 12: 20-21.
- Olsen, P.D., Vestjens, W.J.M. & Olsen, J. (1979). Observations on the diet of the Australian Kestrel. *Emu* 79: 133-138.
- Olson, S.L. (1976). The affinities of the falconid genus *Scapicaptus*. *Auk* 93: 633-636.
- Olson, S.L. (1980). The significance of the distribution of the Megapodidae. *Emu* 80: 21-24.
- Olson, S.L. (1985). The Fossil Record of Birds. Pp. 70-238 in: Famer, D.S., King, J.R. & Parkes, K.C. eds (1985). *Avian Biology*, Vol. 8. Academic Press, New York.
- Olson, S.L. (1987). Variation in the procoracoid foramen in the Accipitridae. *Rev. Ital. Ornitol.* 57(3-4): 161-164.
- Olson, S.L. & James, H.F. (1991). *Descriptions of Thirty-two New Species of Birds from the Hawaiian Islands. Part I. Non-Passeriformes*. American Ornithologists' Union, Washington.
- Olwagen, C.D. (1984). Breeding behaviour of the Red-necked Falcon in captivity. Pp. 23-30 in: *Proc. 2nd Symp. Afr. Pred. Birds*. Natal Bird Club, Durban.
- Olwagen, C.D. & Olwagen, K. (1984). Propagation of captive Red-necked Falcons *Falco chrysurus*. *Koedoe* 27: 45-60.
- Oniki, Y. & Wilson, E.O. (1982). Breeding records of birds from Manaus, Brazil. Part I: Accipitridae to Caprimulgidae. *Rev. Brasil. Biol.* 42(4): 733-740.
- Opdam, P. (1975). Inter- and intraspecific differentiation with respect to feeding ecology in two sympatric species of the genus *Accipiter*. *Ardea* 63: 30-55.
- Opdam, P. (1978). Feeding ecology of a Sparrowhawk (*Accipiter nisus*) population. *Ardea* 66: 137-155.
- Opdam, P., Burgers, J. & Muskens, G. (1987). Population trend, reproduction, and pesticides in Dutch Sparrowhawks following the ban of DDT. *Ardea* 75: 205-212.
- Opdam, P., Thissen, J., Verschuren, P. & Muskens, G. (1977). Feeding ecology of a population of Goshawk (*Accipiter gentilis*). *J. Orn.* 118: 35-51.
- Orcutt, F.S. & Orcutt, A.B. (1976). Nesting and parental behaviour in domestic Common Quail. *Auk* 93: 135-141.
- Orians, G.H. & Paulson, D.R. (1969). Notes on Costa Rican birds. *Condor* 71(4): 426-431.
- Ormistoun, J.H. (1966). *The Food Habits, Habitat, and Movements of Mountain Quail in Idaho*. MSc. thesis, University of Idaho, Moscow, USA.
- Ornat, A.L., Lynch, J.E. & de Montes, B.M. (1989). New and noteworthy records of birds from the eastern Yucatán Peninsula, Mexico. *Wilson Bull.* 101(3): 390-409.
- Ortega, H. & Aragón, A. (1981). Estudio preliminar de la familia Cracidae en la zona de El Trunfo, Estado de Chiapas. Pp. 93-100 in: Estudillo López (1981).
- Ortiz, E. (1980). Estudio preliminar sobre la Pava de Ala Blanca (*Penelope albigularis*). Unpublished report. Lima, Peru.
- Ortiz, E. & O'Neill, J.P. (1988). Situación actual de la familia Cracidae en Perú. Unpublished report presented at the II International Cracid Symposium, Caracas, Venezuela, February/March 1988.
- Ortiz, E. & Purisaca, J. (1981). Estudio preliminar sobre la Pava de Ala Blanca. Pp. 192-202 in: Estudillo López (1981).
- Ortiz, F. (1981). Taxonomía, distribución, estado actual y perspectivas de las poblaciones de crácidos ecuatorianos. Pp. 162-175 in: Estudillo López (1981).
- Ortiz, F. (1985). Notes on the status of diurnal raptor populations in Ecuador. Pp. 21-79 in: Chancellor & Mayberry (1985).
- Ortiz, F. & Carrion, J.M. (1991). *Introducción a las Aves del Ecuador*. H.C.O.D.E.S., Quito, Ecuador.
- Ortleib, R. (1981). *Die Sperber*. Neue Brehm Bucherei-Hef 523. A. Ziemsen, Weinberg Lühdersburg.
- Osborne, T.O. (1981). Ecology of the Red-necked Falcon *Falco chrysurus* in Zambia. *Br. Birds* 123: 289-297.
- Osborne, T.O. (1982). Observations on the Tawny Eagle *Aquila rapax* in southern Zambia. *Ostrich* 53: 107-111.
- Osborne, T.O. (1984). Red-necked Falcon populations in Zambia. Pp. 31-42 in: *Proc. 2nd Symp. Afr. Pred. Birds*. Natal Bird Club, Durban.
- Osborne, T.O. & Colebrook-Robjent, J.F.R. (1982). Nesting of the Greater Kestrel *Falco tinnunculus* in Zambia. *J. Raptor Res.* 16: 71-76.
- Osborne, T.O. & Colebrook-Robjent, J.F.R. (1984). Observations on the Lanner Falcon in eastern Zambia. Pp. 19-22 in: *Proc. 2nd Symp. Afr. Pred. Birds*. Natal Bird Club, Durban.
- Osborne, T.O. & Osborne, L. (1991). A short week in Papua New Guinea. *Musik* 5: 21-23.
- Osterlög, S. (1977). Migration, wintering areas, and site tenacity of the European Osprey. *Ornis Scand.* 8: 61-78.
- Ostl, F. (1981). Indagine sull'alimentazione autoctona-invasiva della *Perisoreus* *perisoreus*. *Ap. L'ornitologia*. *Monte dei Turchi*. *Ornitho. Przewod.* 49(1): 65-80.
- Ostrovskij, A.I. (1973a). [Some data on the breeding of the Capercaille in the Carpathians]. *Vestn. orn.* 4: 21-24.
- Ostrovskij, A.I. (1973b). [Peculiarities of the Capercaille distribution in the Carpathians]. Pp. 116-138 in: [Hunting development in the USSR]. Kiev. In Russian.
- Ostrowski, L. (1993). An observation of *Buteo* *butor* *butor* in southern Patagonia. *Bull. orn. Orn. Club* 113: 62-63.
- Ouellet, H. (1990). A new Ruffed Grouse (Aves: Phasianidae) *Bonasa umbellus* from Labrador, Canada. *Can. Field-Nat.* 104: 445-449.
- Ouellet, H. (1991). Description of the courtship and copulation behaviour of the Crane-hawk. *J. Field Orn.* 62(3): 403-406.
- Ouse, A.J. (1991). The status of cracids in aviculture. Pp. 224-228 in: *AAZPA 1991 Regional Proceedings*.
- Owen, J.H. (1916). Some breeding habits of the Sparrowhawk. *British Birds* 10: 2-10, 26-37, 50-59, 74-86, 106-115, 12: 61-65, 74-82, 13: 114-124, 15: 74-77.
- Owen, J.H. (1926). The eggs of the Sparrowhawk. *British Birds* 20: 114-120.
- Owen, J.H. (1931a). The feeding habits of the Sparrowhawk. *British Birds* 25: 151-155.
- Owen, J.H. (1931b). The hunting of the Sparrowhawk. *British Birds* 25: 238-243.
- Owen, J.H. (1932). The food of the Sparrowhawk. *British Birds* 26: 34-40.
- Owen, R.P. (1977). Terrestrial vertebrate fauna of the Pitcair Islands. Unpublished Report to Office of the Chief Conservationist, Trust Territory of the Pacific Islands, Koror, Palau.
- Owre, O.T. & Northington, P. (1961). Indication of the sense of smell in the Turkey Vulture *Cathartes aura* from feeding tests. *Amer. Midl. Naturalist* 66: 200-205.
- Paccanella, S.A., Antonelli, E., Lara, V.I. & Scherer, P. (1991). Contribución al conocimiento de la fauna aviar de la zona de la Pampa. Pp. 17-18 in: *Orn. D.C. & da Silva, J.M.C. eds (1991). I Congresso Brasileiro de Zoologia, Resumos*. Museu Paraense Emílio Goeldi, Belém.

- Pache, P.H. (1974). Notes on prey and reproductive biology of Harris' Hawk in southeastern New Mexico. *Wilson Bull.* 86(1): 72-74.
- Pacheco, J.F. & da Fonseca, P.S.M. (1990). Resultados de excursão ornitológica a determinadas áreas dos estados de São Paulo, Santa Catarina e Rio Grande do Sul, Janeiro 1990. Unpublished report.
- Packham, C. (1985). Role of male Kestrel during incubation. *British Birds* 78: 194.
- Paganin, M. & Meneguz, P.G. (1992). Gut length of wild and reared Rock Partridges (*Alectoris graeca*): its role in release success. Pp. 709-715 in: Birkan, Potts et al. (1992).
- Page, R.E. & Bergerud, A.T. (1988). A genetic explanation for ten-year cycles of grouse. Pp. 423-438 in: Bergerud & Griston (1988b).
- Pain, D.J., Amiard-Triguet, C., Basoux, C., Burneleau, G., Eon, L. & Nicolau-Guillaumet, P. (1993). Lead poisoning in wild populations of Marsh Harriers *Circus aeruginosus* in the Camargue and Charente-Maritime, France. *Ibis* 135(4): 379-386.
- Pakenham, R.H.W. (1979). *The Birds of Zanzibar and Pemba*. BOU Check-list 2. British Ornithologists' Union, London.
- Palásthy, J. & Meyburg, B.U. (1973). Zur Ernährung des Schreiadlers (*Aquila pomarina*) in der Ostslowakei unter atypischen klimatischen Bedingungen. *Orn. Mit.* 25: 61-72.
- Palma, L. (1990). The Present Situation of Birds of Prey in Portugal. Pp. 3-14 in: Newton & Chancellor (1985).
- Palma, L., Cancela da Fonseca, L. & Oliveira, L. (1984). L'alimentation de l'Aigle de Bonelli (*Hieraetus fasciatus*) dans la côte portugaise. Pp. 87-96 in: CRPR (1984). *Rapinaires Méditerranéens*, II. Centre de Recerca i Protecció de Rapinyaires, Barcelona, Spain.
- Palmer, N.G., Norton, P.M. & Robertson, A.S. (1985). Aspects of the biology of the Forest Buzzard. *Ostrich* 56: 67-73.
- Palmer, P.C. (1990). Observation of a White-tailed Hawk pirating from and talon-grappling with a Swainson's Hawk *Buteo swainsoni*. *Orn. Soc.* 23: 28-29.
- Palmer, R.S. (1974). *Breeding Biology of the Mississippi Kite on the Great Plains*. PhD thesis, University of Kansas, Lawrence.
- Palmer, R.S. (1988). *Handbook of North American Birds*. Vols. 4 & 5. Diurnal Raptors. Yale University Press, New Haven & London.
- Palokangas, P., Alatalo, R.V. & Korpiimäki, E. (1992). Female choice in the Kestrel under different availability of mating options. *Anim. Behav.* 43: 659-665.
- Paludan, K. (1959). On the birds of Afghanistan. *Velensk Medd. Dansk Naturh. Foren.* 122: 1-332.
- Pancheshnikova, Ye.Ye. (1983). [The breeding range of the Imperial Eagle in the territory of the Soviet Union during the second half of the 19th and the beginning of the 20th centuries]. Pp. 146-149 in: *Conservation of Birds of Prev. Moscow*. In Russian.
- Pandey, S. (1991). Western Tragopans in the Saranah pheasantry. *World Pheasant Assoc. News* 33: 29-30.
- Pandey, S. (1993a). Pheasant surveys and the conservation of protected areas in the Upper Beas Valley, Himachal Pradesh, India. Pp. 58-61 in: Jenkins (1993).
- Pandey, S. (1993b). Management and breeding of pheasants in captivity. Pp. 101-105 in: Jenkins (1993).
- Pandolfi, M. & Barocci, A. (1994). Analysis of Montagu's Harrier *Circus pygargus* aerial display during courtship. In: Meyburg & Chancellor (1994a).
- Pandolfi, M. & Pino d'Astoro, P.R. (1988). Aggressività intraspecifica ed interspecifica in Albanello minore (*Circus pygargus*). LI Congr. U.Z.I., 12-16/ix, Camerino. *Boll. Zool.* 55(Suppl.): 78.
- Pandolfi, M. & Pino d'Astoro, P.R. (1990a). Analysis of breeding behaviour in Montagu's Harrier *Circus pygargus* in a site of central Italy. *Avocetta* 14: 97-102.
- Pandolfi, M. & Pino d'Astoro, P.R. (1990b). Food pass behaviour pattern in *Circus pygargus* (L.). XIII Conv. S.I.E., 25-27/iv, Perugia. *Ethology, Ecology & Evolution* 2: 321.
- Panek, M. (1987). Study on the introduction of aviary-reared partridges. Pp. 217-223 in: *Perdix IV, Proceedings of the Grouse Partridge and Ring-necked Pheasant Workshop*.
- Panek, M. (1992). Mechanisms determining population levels and density regulation in Polish Grey Partridges *Perdix perdix*. Pp. 325-335 in: Birkan, Potts et al. (1992).
- Pang Bing-zhang (1964). Courtship behaviour of the Golden Pheasant *Chrysolophus pictus*. *Chinese J. Zool.* 6(4): 155-158.
- Pang Bing-zhang (1990). Comparative courtship behaviour of pheasants. Pp. 98-100 in: Hill et al. (1990).
- Pankin, N.S. (1972). [On the feeding of the Greater Spotted Eagle (*Aquila clanga* Pallas) in the Bureya River valley (Amur region)]. Pp. 331-333 in: *Zool. problems of Siberia. Material of the IV Meeting of Zool. of Siberia*. Nauka, Sibir Dept. Novosibirsk. In Russian.
- Parellada, X. (1984a). Contribució a la identificació del Trencalós (*Gypaetus barbatus*). Pp. 13-15 in: CRPR (1984). *Rapinaires Méditerranéens II*. Centre de Recerca i Protecció de Rapinyaires, Barcelona, Spain.
- Parellada, X. (1984b). Variació dels plomatges i identificació de l'àliga cuabarrada (*Hieraetus fasciatus*). Pp. 70-79 in: CRPR (1984). *Rapinaires Méditerranéens II*. Centre de Recerca i Protecció de Rapinyaires, Barcelona, Spain.
- Parker, H. (1981). Renesting biology of Norwegian Willow Ptarmigan. *J. Wildl. Manage.* 45: 858-864.
- Parker, J.W. (1976). Pesticides and eggshell thinning in the Mississippi Kite. *J. Wildl. Manage.* 40: 243-248.
- Parker, J.W. (1977). A second record of the Mississippi Kite in Guatemala. *Auk* 94: 1968-1969.
- Parker, J.W. (1984). Status report: the American Swallow-tailed Kite. *Eyes* 7: 12-13.
- Parker, J.W. & Ogden, J.C. (1979). The recent history and status of the Mississippi Kite. *Amer. Birds* 33: 119-129.
- Parker, J.W. & Potts, M. (1982). Yearling Mississippi Kite helpers at nests. *J. Raptor Res.* 16: 14-17.
- Parker, M. (1986). *The Foraging Behavior and Habitat Use of Breeding Red-shouldered Hawks (Buteo lineatus) in Southeastern Missouri*. MSc thesis, University of Missouri-Columbia, Columbia, Missouri.
- Parker, M. (1990). Reproductive biology, home range, and prey studies of the Laughing Falcon (*Herpetotheres cachimans*). Pp. 159-171 in: Burnham et al. (1990).
- Parker, M. (1991a). The breeding biology and diet of Laughing Falcons (*Herpetotheres cachimans*) in pristine and modified tropical forest habitats. Pp. 115-120 in: Whitacre et al. (1991).
- Parker, M. (1991b). Diet and hunting behavior at four Bat Falcon (*Falco ruficularis*) nests in primary lowland tropical forest. Pp. 133-135 in: Whitacre et al. (1991).
- Parker, M. (1993). Dietary and energetic analysis of Bat Falcon pairs during the breeding season in Tikal, Guatemala. *J. Raptor Res.* 27(1): 78.
- Parker, S. (1963). Eggs of *Francolinus africanus lori* and *Creatophora cinerea* from Somaliland. *Ool. Rec.* 37: 41-42.
- Parker, S. (1967). The eggs of the Wattle Brush-turkey *Aepyodius arfakianus* (Salvadori) (Megapodiidae). *Bull. Brit. Orn. Club* 87: 92.
- Parker, T.A. & O'Neill, J.P. (1980). Notes on little known birds of the Upper Urubamba Valley, Southern Peru. *Auk* 97(1): 167-176.
- Parker, T.A., Bates, J.M. & Cox, G. (1992). Rediscovery of the Bolivian Recurvebill with notes on other little-known species of the Bolivian Andes. *Auk* 104(1): 173-178.
- Parker, T.A., Hilly, S. & Robbins, M. (1976). Birds of El Triunfo cloud forest, Mexico, with notes on the Horned Guan and other species. *Amer. Birds* 30: 779-782.
- Parker, T.A., Parker, A. & Plenge, M.A. (1982). *An Annotated Checklist of Peruvian Birds*. Buteo Books, Vermillion, South Dakota.
- Parker, T.A., Remsen, J.V. & Heindel, J.A. (1980). Seven bird species new to Bolivia. *Bull. Brit. Orn. Club* 100(2): 160-162.
- Parker, T.A., Schulenberg, T.S., Graves, G.R. & Braun, M.J. (1985). The avifauna of the Huancabamba region, northern Peru. Pp. 169-197 in: Buckley et al. (1985).
- Parkes, K.C. (1958). Specific relationships in the genus *Elanus*. *Auk* 60: 139-140.
- Parkes, K.C. (1971). Taxonomic and distributional notes on Philippine birds. *Nemouria* 4.
- Parkes, K.C. (1973). Annotated list of the birds of Leyte Island, Philippines. *Nemouria* 11.
- Parmalee, P.W. (1954). The vultures, their movements, economic status and control in Texas. *Auk* 71: 443-453.
- Parmalee, P.W. & Parmalee, B. (1967). Results of banding studies of Black Vultures in eastern North America. *Condor* 69: 146-155.
- Parr, S.J. (1985). The breeding ecology and diet of the Hobby *Falco subbuteo* in southern England. *Ibis* 127: 60-73.
- Parr, S.J. (1991). Occupation of new conifer plantations by Merlins in Wales. *Bird Study* 38: 103-111.
- Parrish, J.R. & White, C.M. (1987). Commentary - CITES classification of the Gyrfalcon. *J. Raptor Res.* 21: 40.
- Parrish, J.R., Stoddard, J. & White, C.M. (1987). Sexually mosaic plumage in female American Kestrel. *Condor* 89: 911-913.
- Partridge, W.H. (1961). *Accipiter pectoralis*, a synonym of *Accipiter poliopterus*. *Condor* 63: 505-506.
- Pasmore, R.E. (1980). *Managers' Project 1082 Unconquered bird species WWF Yearbook 1979-80*. 128-129.
- Pasquiter, R.F. (1980b). Report and management plan on ICBP's project for the conservation of forest birds of Madagascar. Unpublished report.
- Patrikeev, M.V. (1990). [On the breeding of the Imperial Eagle in the Karayarskiy forest, western Azerbaijan]. Page 75 in: [Rare and little-studied birds of the northern Caucasus]. Material scient.-pract. conference, Stavropol. In Russian.
- Patrikeev, M.V. (1993). *The Birds of Azerbaijan*. Draft MS.
- Patrimonio, O. (1987). La reproducción de l'Épervier (*Accipiter nisus*) en Corse. Pp. 177-184 in: Baccetti & Spagnesi (1987).
- Pattee, O.H. (1987). The role of lead in condor mortality. *Endangered Species Bull.* XII(9): 6-7.
- Pattee, O.H. & Beasom, S.L. (1979). Supplemental feeding to increase Wild Turkey productivity. *J. Wildl. Manage.* 43(2): 512-516.
- Patterson, R.L. (1952). *The Sage Grouse in Wyoming*. Sage Books, Denver.
- Pauli, H.R. (1974). Zur Winterökologie der Birkhühns *Tetrao tetrix* in den Schweizer Alpen. *Orn. Beob.* 71: 247-278.
- Pauli, H.R. (1979). Zur Bedeutung von Nährstoffgehalt und Verdauulichkeit der wichtigsten Nahrungspflanzen des Birkhühns *Tetrao tetrix* in den Schweizer Alpen. *Orn. Beob.* 75: 57-84.
- Pauli, D. (1991). Foraging and breeding behaviour of the Australian Kestrel *Falco cerchneides* on the Northern Tablelands of New South Wales. *Austr. Bird Watcher* 14(3): 85-92.
- Páez, E.F., González, C.A. & Jiménez, J.F. (1992). Diet shifts of Black-chested Eagles (*Geranoaetus melanoleucus*) from native prey to European rabbits in Chile. *J. Raptor Res.* 26(1): 27-32.
- Paxton, M. & Brown, C. (1987). Rednecked Falcons nesting in palm trees in Namibia. *Gabor* 2: 12-13.
- Paynter, R.A. (1955). The ornithogeography of the Yucatán Peninsula. *Peabody Mus. Nat. Hist. Bull.* 9.
- Paz, U. (1987). *The Birds of Israel*. Christopher Helm, Bromley, Kent, UK.
- Peola, S. (1991). Eine Bodenbrut des Schreiadlers *Aquila pomarina*. Pp. 259-264 in: Chancellor & Meyburg (1991).
- Peakall, D.B. & Kiff, L.F. (1979). Eggshell thinning and DDE residue levels among Peregrine Falcons *Falco peregrinus*: a global perspective. *Ibis* 121(2): 200-204.
- Peakall, D.B. & Kiff, L.F. (1988). DDE contamination in Peregrines and American Kestrels and its effects on reproduction. Pp. 337-350 in: Cade et al. (1988).
- Peale, T.R. (1848). Mammals and ornithology (in US Exploring Expeditions during the years 1838, 1839, 1840, 1841, 1842, Vol VIII). C. Sherman, Philadelphia.
- Pearman, M. (1993a). The avifauna of the Río Machariño dry forest, northern La Paz Department, Bolivia: a preliminary investigation. *Bird Conserv. Int.* 3: 105-117.
- Pearman, M. (1993b). Some range extensions and five species new to Colombia, with notes on some scarce or little known species. *Bull. Brit. Orn. Club* 113: 66-75.
- Pearson, D.J. & Meadows, B.S. (1979). Lesser Spotted Eagle *Aquila pomarina* in Kenya during 1978/79, with comments on the identification of the species. *Scopus* 3: 48-53.
- Pearson, D.L. (1975). Un estudio de las aves de Tumichuca. *Pumapunku* 8: 50-56.
- Pearson, O.P. & Ralph, C.P. (1978). The diversity and abundance of vertebrates along an altitudinal gradient in Peru. *Mem. Mus. Hist. Nat. Javier Prado* 18.
- Peck, G.K. & James, R.D. (1983). *Breeding Birds of Ontario: Nidology and Distribution*. Vol 1. Nonpasserines. Royal Ontario Museum, Toronto, Canada.
- Peckover, W.S. & Filewood, L.W.C. (1976). *Birds of New Guinea and Tropical Australia*. A.H. & A.W. Reed, Sydney.
- Pedersen, H.C. (1984). Territory size, mating status, and individual survival of males in a fluctuating population of Willow Ptarmigan. *Ornis Scand.* 15: 197-203.
- Pedersen, H.C. (1990). Reproductive behaviour and breeding numbers in a fluctuating population of Norwegian Willow Grouse *Lagopus lagopus*: summary of a 10-year study. *Fauna Norvegica (Ser. C, Cinclus)* 13: 1-10.
- Pedersen, H.C. & Steen, J.B. (1979). Behavioural thermoregulation in Willow Ptarmigan *Lagopus lagopus* chicks. *Ornis Scand.* 10: 17-21.
- Pedersen, H.C. & Steen, J.B. (1985). Parental care and chick production in a fluctuating population of Willow Ptarmigan. *Ornis Scand.* 16: 270-276.
- Pedersen, H.C., Steen, J.B. & Andersen, R. (1983). Social organization and territorial behaviour in a Willow Ptarmigan population. *Ornis Scand.* 14: 263-272.
- Peel, J.R. (1976). Breeding and other notes on the Black-shouldered Kite. *S. Austr. Orn.* 27: 139-141.
- Peck, L.L. (1972). *The Francolins of Kote National Park, with special reference to Red-necked and Swainson's Francolin*. Unpublished Dissertation for a Certificate in Field Ecology, University of Rhodesia (Zimbabwe).
- Peters, H.J. (1963). Einiges über den Waldfalken, *Microstrus semitorquatus*. *J. Orn., Leipzig* 104: 357-364.
- Pekins, P.J. (1983). *Winter Ecological Energetics of Blue Grouse*. PhD thesis, Utah State University, Logan.
- Pekins, P.J., Gessaman, J.A. & Lindzey, F.G. (1992). Winter energy requirements of Blue Grouse. *Can. J. Zool.* 70: 22-24.
- Pekins, P.J., Lindzey, F.G. & Gessaman, J.A. (1991). Physical characteristics of Blue Grouse's winter use of trees and roost sites. *Great Basin Nat.* 51: 244-248.
- Pekins, P.J., Lindzey, F.G., Robertson, J.A., McDaniel, G. & Berger, R. (1989). Winter habitats and foods of Blue Grouse in the Sheeprock Mountains, Utah. *Great Basin Nat.* 49: 229-232.
- Pendergast, B.A. (1969). *Nutrition of Spruce Grouse in the Swan Hills, Alberta*. MSc thesis, University of Alberta, Edmonton.
- Pendergast, B.A. & Boag, D.A. (1970). Seasonal changes in diet of Spruce Grouse in central Alberta. *J. Wildl. Manage.* 34: 605-611.
- Pendergast, B.A. & Boag, D.A. (1971). Nutritional aspects of the diet of Spruce Grouse in central Alberta. *Condor* 73: 437-443.
- Pendergast, B.A. & Boag, D.A. (1973). Seasonal changes in the internal anatomy of Spruce Grouse in Alberta. *Auk* 90: 307-317.
- Penny, M. (1968). Endemic birds of the Seychelles. *Orn. J.* 267-275.
- Penny, M. (1974). *The Birds of Seychelles and the Outlying islands*. Collins, London.
- Pennycook, C.J. (1972). Soaring behaviour and performance of some East African birds, observed from a motor-glider. *Ibis* 114: 178-218.
- Pennycook, C.J. (1976). Breeding of the Lappet-faced and White-headed Vultures (*Torgus tracheliotus* Forster and *Trigoniceps occipitalis* Burchell) on the Serengeti Plains, Tanzania. *East Afr. Wildl. J.* 14: 67-84.
- Pennycook, C.J. (1983). Effective nest density of Rüppell's Griffon Vulture in the Serengeti-Rift Valley area of northern Tanzania. Pp. 172-184 in: Wilbur & Jackson (1983).
- Pennycook, C.J. & Scholey, K.D. (1984). Flight behaviour of Andean Condors *Vultur gryphus* and Turkey Vultures *Cathartes aura* around the Paracas Peninsula, Peru. *Ibis* 126: 253-256.
- Pennycook, C.J., Fuller, M.R. & McAllister, L. (1989). Climbing performance of Harris' Hawks (*Parabuteo unicinctus*) with added load: implications for muscle mechanics and for radiotracking. *J. Exper. Biol.* 142: 17-29.
- Penzhorn, B.L. (1969). Golden Gate se Lammergeiers. *Afr. Wildl.* 23: 289-298.
- Penzhorn, B.L. (1976). Grootwitvalke. Ratsels en jakkalse. *Lamariers* 4: 18-19.
- Penzhorn, B.L., Horak, I.G., Spickett, A.M. & Braack, L.E.O. (1991). Morphometrics of Helmeted Guineafowl from the Kruger National Park. *S. Afr. J. Wildl. Res.* 21(2): 62-66.
- de la Peña, M.R. (1979). *Aves de la Provincia de Santa Fé*. Ministerio de Agricultura y Ganadería de la Provincia de Santa Fé, Santa Fé, Argentina.
- de la Peña, M.R. (1992). *Guía de Aves Argentinas*. 2nd edition. Vol. 2. Falconiformes-Charadriiformes. Literature of Latin America (L.O.L.A.). Buenos Aires.
- Pepin, D. (1984). Partner changing in the Red-legged Partridge *Alectoris rufa*. *Oiseau et RFO* 54: 293-304.
- Pepler, D. (1991). Diet of the Hobby Falcon *Falco subbuteo* in the southwestern Cape, *Ostrich* 62: 74-75.
- Pepler, D. (1993). Diet and hunting behaviour of the European Hobby in Africa. Pp. 163-170 in: Nicholls & Clarke (1993).
- Pepper, G.W. (1972). *The Ecology of Sharp-tailed Grouse During Spring and Summer in the Aspen Parklands of Alberta*. Wildlife Report No. 1. Saskatchewan Department of Natural Resources.
- Pepper-Edwards, D.L. & Nolte, E. (1991a). Plumage changes of a captive Black-breasted Buzzard *Haminstra melanosternus*. *Corolla* 15: 77-78.
- Pepper-Edwards, D.L. & Nolte, E. (1991b). Observations of a captive Black-breasted Buzzard *Haminstra melanosternus* using stones to break open eggs. *Austr. Bird Watcher* 14: 103-106.
- de la Perche, N. (1992). Preliminary results of research on the Double-spurred Francolin of Morocco (*Francolinus bicoloratus ayesha* - Hartert, 1917). Pp. 883-884 in: Birkan, Potts et al. (1992).
- Perco, F., Toso, S., Sucic, G. & Apollonio, M. (1983). Initial data for a study on the status, distribution and ecology of the Griffon Vulture *Gyps fulvus fulvus* in the Karina Archipelago, Yugoslavia. *Larus* 33-55: 99-134.
- Perez, J.L., Morales, M. & Velasco, J. (1990). *El Águila de Bonelli (Neophron perennius) en España. Población, Distribución, Problemática y Conservación*. Colección Técnica. ICONA, Madrid.
- Pérez, P. (1984). Contribución al conocimiento de la historia natural de la especie *Neophron perennius* (Linné) en la provincia de Murcia. Unpublished report.
- Pérennou, C. (1989). *L'Aigle de Bonelli*. Edition Fonds d'investissement pour les Rapaces (FIR), Saint Cloud, France.
- Pérennou, C., Fly, M. & Cantournet, D. (1987). Note sur un cas de polyandrie chez le Vautour pérennien *Neophron perennius*. *Alauda* 55: 73-75.
- Pererva, V.I. (1984). [The Imperial Eagle]. Pp. 124-125 in: Borodin (1984). In Russian.
- Pererva, V.I. (1989). [On three species of eagles in need of protection according to the Red Data Book of the USSR]. *Probl. gos. kadestra zivot. miru USSR*: 65-72. In Russian.
- Pererva, V.I. & Gruzdevskaya, A.V. (1983). [Ecological and behavioural adaptations of the Steppe Eagle to power lines]. Pp. 42-45 in: [Ecology of birds of prey]. In Russian.

- Peres, C.A. (1990). A Harpy Eagle successfully captures an adult male red howler monkey. *Wilson Bull.* 102(3): 560-561.
- Pereyra, J.A. (1937). Contribución al estudio y observaciones ornitológicas de la zona norte de la gobernación de La Pampa. *Memorias del Jardín Zoológico* 7: 198-326.
- Pereyra, J.A. (1950). Las aves del territorio de Misiones. *Anales del Museo Nahuel Huapi* P. F. Moreno 2: 1-40.
- Pérez-Mellado, V., Bueno, J.M. & Arroyo, B. (1977). Comportamiento de *Hieraaetus fasciatus* en el nido. *Ardeola* 23: 81-102.
- Perrins, C.M. (1992). Local adaptation in fragmented habitats. Pp. 643-645 in Birkan, Potts et al. (1992).
- Perrins, C.M., Lebreton, J.D. & Hiron, G.S.J. (1991). *Bird Population Studies. Relevance to Conservation and Management*. Oxford University Press, Oxford.
- Peter, H.U. & Zausmeil, J. (1982). [Population ecology of the Kestrel *Falco tinnunculus* in a colony near Jenu]. *Ber. Vogelwarte Huddensee* 3: 5-17.
- Peterle, T.J. (1951). Intergeneric galliform hybrids: a review. *Wilson Bull.* 63: 219-224.
- Peters, J.L. (1934). *Check-list of Birds of the World*, Vol. 2. Museum of Comparative Zoology, Harvard University Press, Cambridge, Massachusetts.
- Peters, S.S. (1958). Food habits of the Newfoundland Willow Ptarmigan. *J. Wildl. Manage.* 22: 384-394.
- Petersen, B.E. (1980). *Breeding and Nesting Ecology of Female Sage Grouse in North Park, Colorado*. MSc thesis, Colorado State University, Fort Collins.
- Petersen, C.M. (1956). [Studies of the breeding biology of the Kestrel (*Falco tinnunculus* L.) in Copenhagen]. *Dan. Orn. Foren. Tidssk.* 50: 134-159. In Danish with English summary.
- Petersen, L.R. & Thompson, D.R. (1977). Ageing nestling raptors by 4th primary measurements. *J. Wildl. Manage.* 41: 587-590.
- Peterson, J.G. (1970). The food habits and summer distribution of juvenile Sage Grouse in central Montana. *J. Wildl. Manage.* 34: 147-155.
- Petrelli, F. (1988). Notes on the behaviour and ecology of the Short-toed Eagle in Italy. *Le Gerfaut* 78: 261-286.
- Petrides, G.A. (1942). Age determination in American gallinaceous birds. *Trans. North Amer. Wildl. Nat. Resour. Conf.* 7: 308-328.
- Petrides, G.A. & Nestler, R.B. (1943). Age determination in juvenile Bobwhite Quail. *Amer. Midl. Naturalist* 30: 774-782.
- Petrie, M., Halliday, T.R. & Sanders, C. (1990). Peahens prefer peacocks with elaborate trains. *Anim. Behav.* 41: 323-332.
- Petrov, P.A. & Rozhkov, A.A. (1965). [Materials on the breeding and numbers of the Steppe Eagle in the southeastern steppes of the Kalmyk ASSR]. Pp. 103-108 in: *Materialy zool. sovescunij po probleme "Biol. osnovy rekonsstrukcii racional'no go ispol'zovanija i ochrany fauny južnoj zony Evropejskoj Casti SSSR"*. Kishinev. In Russian.
- Petrov, T., Iankov, P., Darackiev, A., Nikolov, K., Michev, T., Porfirov, L. & Milchev, B. (1994). State of the Imperial Eagle (*Aquila heliaca* Savigny) in Bulgaria in the period between 1890 and 1993. In: Meyburg & Chancellor (1994b).
- Pettifor, R.A. (1983a). Seasonal variation, and associated energetic implications, in the hunting behaviour of the Kestrel. *Bird Study* 30: 201-206.
- Pettifor, R.A. (1983b). Territorial behaviour of Kestrels in arable fenland. *British Birds* 76: 206-214.
- Pettigrew, J.D. (1982). A note on the eyes of the Letter-winged Kite *Elanus scriptus*. *Emu* 82: 305-308.
- Petty, S.J. (1989). *Goshawks: their Status, Requirements and Management*. Forestry Commission Bulletin 81. HMSO.
- Peyton, L. (1915). Nesting of the White-tailed Kite at Sespe, Ventura County, California. *Condor* 17: 230-232.
- Pfeffer, J.J. (1992). Discovery of *Lagopus mutus* in the Pamir Ala Mountains (Tadjikistan). *Gruse News* (Dec.): 6-7.
- Pfeffer, P.G. (1991). [Biology of the Red-necked Shaheen in Kazakhstan]. Pp. 114-135 in: *Rare Species of Birds and Animals of Kazakhstan*. State Comm. Ecol., Alma Ata. In Russian.
- Phelps, W.H. & Phelps, W.H. (1958). Lista de las aves de Venezuela con su distribución. Tomo II, Part I. *Bol. Soc. Venez. Cienc. Nat.* 90: 1-317.
- Phelps, W.H. & Phelps, W.H. (1962). Two new subspecies of birds from Venezuela, the rufous phase of *Pauxi pauxi*, and other notes. *Proc. Biol. Soc. Washington* 75: 199-204.
- Phillips, A.R. (1958). Las subspecies de la Codorniz de Gambel y el problema de los cambios climáticos en Sonora. *Sobretiro de los Anales del Instituto de Biología*. T. 24: 361-374.
- Phillips, A.R. (1966). Further systematic notes on Mexican birds. *Bull. Brit. Orn. Club* 86: 86-94.
- Phillips, J., Steen, J.B., Raen, S.G. & Aaherud, F. (1992). Effects of burning and cutting on vegetation and on the population of Willow Grouse *Lagopus lagopus* in Norway. *Fauna Norvegica (Ser. C. Cinclus)* 15: 37-42.
- Phillips, J.C. (1921). A further report on species crosses in birds. *Genesee* 6: 366-83.
- Phillips, R.L. (1967). Fall and winter food habits of Ruffed Grouse in northern Utah. *J. Wildl. Manage.* 31: 827-829.
- Phillips, W.W.A. (1933). Some observations on the nesting of a pair of Ceylon Shikra Hawks (*Accipiter badius badius* Gmelin). *J. Bombay Nat. Hist. Soc.* 36: 509-511.
- Phillips, W.W.A. (1953). *A (1952) Revised Checklist of the Birds of Ceylon*. Museums of Ceylon, Natural History Series (Zoology).
- Phillips, W.W.A. (1978). *Annotated Checklist of the Birds of Ceylon*. Revised edition. Wildlife & Nature Protection Society of Ceylon in association with the Ceylon Bird Club.
- Piao Ren-zhu, Wang Wei-min et al. (1984). Breeding habits of the Ring-necked Pheasant. *Chinese Wildlife* 18(2): 1-5.
- Pickford, P., Pickford, B. & Tarboton, W.R. (1989). *Southern African Birds of Prey*. Struik, Cape Town.
- Pickwell, G.B. (1930). The White-tailed Kite. *Condor* 32: 221-239.
- Pickwell, G.B. (1932). Requiem for the White-tailed Kites of Santa Clara Valley. *Condor* 34(1): 44-45.
- Picozzi, N. (1978). Dispersion, breeding and prey of the Hen Harrier in Glen Dye, Kincardineshire. *Ibis* 120: 498-509.
- Picozzi, N. (1980). Food, growth, survival, and sex-ratio of nestling Hen Harriers, *Circus c. cyaneus*, in Orkney. *Ornis Scandin.* 11: 1-11.
- Picozzi, N. (1984). Sex ratio, survival and territorial behaviour of polygynous Hen Harriers (*Circus c. cyaneus*) in Orkney. *Ibis* 126: 356-365.
- Picozzi, N. & Weir, D.N. (1976). Dispersion and causes of death in Buzzards. *British Birds* 69: 193-201.
- Picozzi, N., Catt, D.C. & Moss, R. (1992). Evaluation of Capercaillie habitat. *J. Appl. Ecol.* 29: 751-762.
- Piechocki, R. (1982). *Der Turmfalke* (Falcon tinnunculus). Neue Brehm Bucherei-Heft 116(6). A. Ziemsen Verlag, Wittenberg Luthardt.
- Piechocki, R., Stubbe, M., Uhlenhaut, K. & Sumjaa, D. (1981). Beiträge zur Avifauna der Mongolei. *Mitt. Zool. Mus. Berlin* 57(Suppl. Ann. Orn. 5): 71-128.
- Pielowski, Z. (1988). *Proceedings of the Common Partridge International Symposium*. Warsaw.
- Pierce, R. & Maloney, R. (1989). Responses of the Harrier in the MacKenzie Basin to the abundance of rabbits. *Notornis* 36: 114-116.
- Pietz, P.J. & Tester, J.R. (1982). Habitat selection by sympatric Spruce and Ruffed Grouse in north central Minnesota. *J. Wildl. Manage.* 46: 391-403.
- Pine, D.S. (1981). Identifying sex of Mountain Quail by length of crest plume. *J. Wildl. Manage.* 45: 1056-1058.
- Pineau, J. & Giraud-Audine, M. (1977). Sur les oiseaux nicheurs de l'extrême nord-ouest du Maroc: reproduction et mouvements. *Alauda* 45: 75-103.
- Pinowski, J. (1961). The food of the Marsh Harrier (*Circus aeruginosus* L.). *Ekol. Polska* 6: 75-60.
- Pinshon, B., Degen, A.A. & Alkon, P.U. (1984). Water intake, existence energy, and responses to water deprivation in the Sand Partridge *Amphispiza hesi* and the Chukar *Alectoris chukar*: two phasianids of the Negev Desert. *Physiol. Zool.* 56: 128-136.
- Pinto, A.A. da Rosa (1970). Um catálogo das aves do distrito da Huila (Angola). *Mem. Trab. Inst. Cient. Angola* 6.
- Pinto, A.A. da Rosa (1983). *Ornitologia de Angola*. Vol. 1. Non Passeres. Instituto de Investigação Científica Tropical, Lisboa.
- Pinto, O.M. de Oliveira (1935). Os mutans do Brasil. *Bol. Bul.* 2(3): 69-75.
- Pinto, O.M. de Oliveira (1935). Sobre as jaçungas de Mato Grosso, com referência especial à validez de *Tupia camuensis* grayi. *Bol. Bul. Nov. Ser.* 3, 2.
- Pinto, O.M. de Oliveira (1946). Comentários sobre as aves descritas na História Natural Brasileira de Jorge Maregrave. *Publ. Zool. São Paulo*.
- Pinto, O.M. de Oliveira (1951). Aves do Itatiaia. *Pap. Avuls. Dep. Zool. São Paulo* 10: 155-208.
- Pinto, O.M. de Oliveira (1952a). Síntese histórica e sistemática da ornitologia de Minas-gerais. *Arg. Zool. São Paulo* 8: 1-84.
- Pinto, O.M. de Oliveira (1952b). Redescobrimiento de *Mitu mitu* (Linné) no nordeste do Brasil (ext. de Alagoas). Provas a independência de *Mitu tuberosus* (Spix) como espécie à parte. *Pap. Avuls. Dep. Zool. São Paulo* 10: 307-314.
- Pinto, O.M. de Oliveira (1954). Resultados ornitológicos de duas viagens científicas ao estado de Alagoas. *Pap. Avuls. Dep. Zool. São Paulo* 12: 1-98.
- Pinto, O.M. de Oliveira. (1964). *Ornitologia Brasileira*. Vol. 1. Parte Introdutória e Famílias Rheidae a Cuculidae. Secretaria da Agricultura do Estado de São Paulo, São Paulo.
- Pinto, O.M. de Oliveira & de Camargo, E.A. (1952). Nova contribuição à ornitologia do Rio das Montes. *Pap. Avuls. Dep. Zool. São Paulo* 10: 213-234.
- Piper, S.E. (1989). Predation attempts by African Goshawks. *Gubur* 4: 24-26.
- Piper, S.E. & Ruddle, P. (1986). An initial evaluation of the Cape Vulture colonies at Mkamabati, Transkei. *Vulture News* 15: 7-12.
- Pitelka, F.A. (1948). Notes on the distribution and taxonomy of Mexican game birds. *Condor* 50: 113-123.
- Pitman, C.R.S. (1948). The occurrence of *Francolinus n. nobilis* in south-western Uganda. *Ibis* 90: 129-130.
- Pitman, C.R.S. (1966). A further note on the breeding of the African Hobby *Falco cinereus* Smith. *Ostrich* 37: 6-7.
- Pizzey, G. (1958). *A Time to Look*. Heinemann, Melbourne.
- Platt, J.B. (1976). Bald Eagles wintering in a Utah desert. *Amer. Birds* 30: 783-788.
- Platt, J.B. (1976b). Gyrfalcon nest site selection and winter activity in western Canadian Arctic. *Canadian Field-Nat.* 90: 338-345.
- Platt, J.B. (1976c). Sharp-shinned Hawk nesting and nest site selection in Utah. *Condor* 78: 102-103.
- Platt, J.B. (1977). *The Breeding Behaviour of Wild and Captive Goshawks in Relation to their Environment and Human Disturbance*. PhD thesis, Cornell University.
- Platt, J.B. (1989). Gyrfalcon courtship and early breeding behavior on the Yukon North Slope. *Sociobiology* 15: 43-69.
- Platt, S.W. (1977). Gyrfalcon in Oklahoma. *Bull. Oklahoma Orn. Soc.* 10: 27-28.
- Platt, S.W. (1978). Successful breeding of immature Prairie Falcons in northeast Colorado. *J. Raptor Res.* 11: 81-82.
- Platt, S.W. (1981). *Prairie Falcon. Aspects of Population Dynamics, Individual Vocal Identification, Mating, and Sexual Maturity*. PhD thesis, Brigham Young University, Provo, Utah.
- Plotnick, R. (1956). Posición sistemática del género *Heterospiza* Hartert. *Ibis* 10: 136-139.
- Plumley, D. & Sharma, V. (1990). A report from the University of Newcastle-upon-Tyne Himalayan Expedition 1989. *World Pheasant Assoc. News* 28: 28-31.
- Pockley, E. (1937). Notes on nesting holes of a megapode. *Ibis* 37: 63-65.
- Pocock, R.I. (1909). Breeding habits of Heck's Curassow. *Amer. Mag.* 7: 23-30.
- Pocock, R.I. (1911). The display of the Peacock Pheasant *Phryganis chinensis*. *Amer. Mag.* 3(2): 229-237.
- Polard, J.R.T. (1947). The Bearded Vulture *Gypsetus meridionalis* Keyserling and Blasius, in Kenya Colony. *Ibis* 89: 120-122.
- Pollock, K.H., Moore, C.T., Davidson, W.R., Kellogg, F.E. & Doster, G.L. (1989). Survival rates of Bobwhite Quail based on band recovery analyses. *J. Wildl. Manage.* 53: 1-6.
- Pollock, K.H., Winterstein, S.R., Bunck, C.M. & Curtis P.D. (1989). Survival analysis in telemetry studies: the staggered entry design. *J. Wildl. Manage.* 53: 7-14.
- Polo, D.J., Celdran, J.F., Peinado, V.J., Viscor, G. & Palomeque, J. (1992). Hematological values for four species of birds of prey. *Condor* 94(4): 1007-1013.
- Pollock, D. (1972). In search of the Mikado Pheasant. 1972 Annual Report of the Pheasant Trust and Norfolk Wildlife Park.
- Polushkin, D.M. (1988). [Population structure of rare birds species in Stolba Reservation and in nearby territories]. Pp. 170-176 in: Shvetsov, Yu.G. ed. *Redkie naseimnye pozvonochnye Sibiri* [Rare terrestrial vertebrates of Siberia]. Nauka, Novosibirsk. 1988. In Russian.
- Pomeroy, D. & Abe, E. (1992). The distribution and abundance of gamebirds in Africa with special reference to the East African francolins. Pp. 527-537 in: Birkan, Potts et al. (1992).
- Pomerey, F. (1984). *L'Aménagement faunistique de la Région de la Vallée de l'Arve (Savoie)*. D.T.A. Université de Montpellier.
- Poole, A.F. (1985). Courtship feeding and Osprey reproduction. *Auk* 102: 479-492.
- Poole, A.F. (1989). *Ospreys: a Natural and Unnatural History*. Cambridge University Press, Cambridge, UK.
- Poole, A.F. & Agler, B. (1987). Recoveries of Ospreys banded in the United States, 1914-1984. *J. Wildl. Manage.* 51: 148-155.
- Poole, A.F. & Gill, F. eds. (1993). *The Birds of North America*. Vol. 2. Academy of Natural Sciences, Philadelphia & American Ornithologists' Union, Washington, D.C.
- Poole, A.F., Settemeier, P. & Gill, F. eds. (1992). *The Birds of North America*. Vol. 1. Academy of Natural Sciences, Philadelphia & American Ornithologists' Union, Washington, D.C.
- Poole, K.G. (1989). Determining age and sex of nesting Gyrfalcons. *J. Raptor Res.* 23: 45-47.
- Poole, K.G. & Boag, D.A. (1988). Ecology of Gyrfalcons, *Falco rusticolus*, in the central Canadian Arctic: diet and feeding behavior. *Can. J. Zool.* 66: 334-344.
- Poole, K.G. & Bromley, R.G. (1988). Natural history of the Gyrfalcon in the Central Canadian Arctic. *Areni* 41: 31-38.
- Poplin, F. & Mourer-Chauviré, C. (1985). *Sylvainus neobaldanica* (Aves, Galliformes, Megapodiidae), oiseau géant éteint de l'île des pins (Nouvelle Calédonie). *Géobios* 18: 73-97.
- Porath, W.R. & Vohs, P.A. (1972). Population ecology of Ruffed Grouse in northeastern Iowa. *J. Wildl. Manage.* 36: 793-802.
- Porkert, J. (1969a). Skeletreste von Kleinsäugetern in der Lösung vom Birkwald (*Larix tetrix* L.) in der Winterperiode. *Zeit. Jagdwiss.* 15: 137-144.
- Porkert, J. (1969b). Zum Überleben unserer Waldhühner im Schnee. *Opera Ornithologica* 6: 93-100.
- Porkert, J. (1972). Zum Grünwechsel bei unseren Waldhühnern (Tetraoniden). *West. Zool.* 36: 134-159.
- Porkert, J. (1975a). Zum Schneefressen der Waldhühner. *Falke* 22: 16-22.
- Porkert, J. (1975b). Methodische Gesichtspunkte zum Studium der Ökologie der bedrohten Tetraoniden Populationen. *Beitr. Jagd-Wildforsch.* 9: 417-429.
- Porkert, J. (1976). Methoden zur Untersuchung der Fortpflanzungsbiologie bedrohter Tetraonidenpopulationen (Aves: Galliformes). *West. Zool.* 40: 41-52.
- Porkert, J. (1979). The influence of human factors in tetraonid populations in Czechoslovakia. Pp. 74-82 in: Lavel (1979).
- Porkert, J. (1980). Vergleichen des Waldbodens als Birkwaldproblem. *Beitr. Vogelf. Naturschutz: Landschaftspflege Bad-Wart.* 16: 75-95.
- Porkert, J. (1983). Einige Faktoren, die die Überlebenschancen der Tetraoniden in den Ostäpiden beeinflussen. *Trans. Congr. Internat. Union Game Biol.* 16: 668-678.
- Porkert, J. (1990). Zu Bastardierungen in den Anstiegs- und Aussterbensphasen einiger mitteleuropäischen Populationen des Auerhahns, *Tetrao urugallus* (Tetraonidae, Aves). *Acta Soc. Zool. Bohemoslov.* 54: 56-68.
- Porkert, J. (1991a). Nebelstürze als Aussterben von Tetraoniden fördernder Faktor in den Ostäpiden. *Acta ornithologica*. Jena 2-3: 195-209.
- Porkert, J. (1991b). Hoarfrost deposits as a factor contributing to the extinction of tetraonids in the eastern Sudetes. *Ornis Scandin.* 22: 292-293.
- Porkert, J. (1992). Störungen in der Prägnanzphase des Kuckens als Ursache abnormen Verhaltens beim Steinmännchen (*Tetrao urugallus*). *Acta ornithologica*. Jena 2: 321-325.
- Porras, J. & Arriaga, I. (1981). Consideraciones sobre el status de la conservación de los crácidos en Venezuela. Pp. 116-154 in: Estudillo López (1981).
- Portal, M. (1924). Incubation by male Red-legged Partridge. *British Birds* 17: 315-316.
- Porter, R.D. & White, C.M. (1973). The Peregrine Falcon in Utah: emphasizing ecology and competition with the Prairie Falcon. *Brigham Young Univ. Sci. Bull.* 18(4): 1-73.
- Porter, R.D., Jenkins, M.A. & Gaski, A.L. (1987). *Working Bibliography of the Peregrine Falcon*. National Wildlife Federation Science Technical Series 9. Washington, D.C.
- Porter, R.F. (1981). Ageing and sexing Rough-legged Buzzards. *Dutch Birding* 3: 79-80.
- Porter, W.F. (1975). *Wild Turkey*. Pp. 1-323. *Wild Turkey*. Pp. 1-323. *Wild Turkey*. Pp. 1-323.
- Porter, W.F. (1977b). Home range dynamics of Wild Turkeys in southeastern Minnesota. *J. Wildl. Manage.* 41(3): 434-437.
- Porter, W.F. (1985a). Partridge genetics. In: Campbell & Lack (1985).
- Porter, W.F. (1985b). Turkey. Pp. 613-614 in: Campbell & Lack (1985).
- Porter, W.F., Tangen, R.D., Nelson, G.C. & Hamilton, D.A. (1980). Effects of corn food plots on Wild Turkeys in the upper Mississippi Valley. *J. Wildl. Manage.* 44(2): 456-462.
- Porter, W.F., Tangen, R.D., Nelson, G.C. & Hamilton, D.A. (1981). Effects of winter corn plots on reproduction in a northern wild turkey population. *J. Wildl. Manage.* 47(2): 281-290.
- Potapov, E.R. & Potapov, A.N. (1990). *Sezonnyy raznoobrazie i struktura populatsii peregrinnoy falcony (Falco peregrinus) v Kolyma Lowlands region (north-eastern Siberia)*. In: Meyburg & Chancellor (1994a).

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- Potapov, R.I. (1966). The birds of the Pamirs. *Proc. Zool. Inst. Ak. Sci. USSR* 39: 1-119.
- Potapov, R.I. (1969). [On the functional value of the horny appendages on the toes of the grouse]. *Zoologicheskii Zhurnal* 48: 1379-1382. In Russian.
- Potapov, R.I. (1970). [Comparative consideration of the genera *Falcipterus* and *Canachites* (Tetraonidae). Asia and North America]. *Trudy Zool. Inst. AN SSSR* 47: 205-235. In Russian.
- Potapov, R.I. (1972). [Adaptations of the family Tetraonidae to the winter season]. *Trudy Zool. Inst. AN SSSR* 55: 207-251. In Russian.
- Potapov, R.I. (1975). [Characteristics of the courtship of the Capercaillie (*Tetrao urogallus* *obsoletus* Snigir.) in northern Karelia]. *Trudy Karelskogo zapovednika* (Murmansk) 9: 159-170. In Russian.
- Potapov, R.I. (1976). [The significance of courtship behaviour in the reproductive isolation of the species of Tetraonidae]. *Trudy Zool. Inst. AN SSSR* 65: 69-78. In Russian.
- Potapov, R.I. (1978). [New data on the Caucasian Black Grouse *Lyrurus mloskiewiczii*]. *Trudy Zool. Inst. AN SSSR* 76: 24-35. In Russian.
- Potapov, R.I. (1982a). [Bioenergetics of grouse during the winter period]. *Trudy Zool. Inst. AN SSSR* 113: 57-67. In Russian.
- Potapov, R.I. (1982b). New data on the Caucasian Black Grouse, *Lyrurus mloskiewiczii* (Tacz.). *Orn. Stud. in the USSR* 1: 102-120.
- Potapov, R.I. (1985). [Fauna of the USSR: Birds. Vol. 3(1). Order Galliformes. Part 2. Family Tetraonidae]. Leningrad. In Russian.
- Potapov, R.I. (1987). Order Galliformes. In: Iliev & Flint (1985-1989).
- Potapov, R.I. (1992a). Systematic position and taxonomic level of grouse in the order Galliformes. *Bull. Brit. Orn. Club* 112A (Centenary Suppl.): 251-259.
- Potapov, R.I. (1992b). Adaptation to mountain conditions and evolution in the snowcocks (*Tetraogallus* spp.). Pp. 647-660 in: Birkan, Potts et al. (1992).
- Potapov, R.I. & Flint, V.E. eds. (1989). Galliformes, Gruiformes. Vol. 4 in: Iliev & Flint (1985-1989).
- Potapov, R.I. & Pavlova, E. (1977). [Peculiarities of the courtship of the Caucasian Black Grouse *Lyrurus mloskiewiczii*]. *Ornithologia* 13: 117-126. In Russian.
- Potts, N.S. (1953). The birds of Calicoon, Philippine Islands. *Wilson Bull.* 65: 252-270.
- Potts, G.R. (1986). *The Partridge*. Collins, London.
- Potts, G.R. (1987). Conservation of pheasant habitat in Asia and a possible role for hunters and aviculturists. Pp. 109-114 in: Savage & Radley (1987).
- Potts, G.R. (1989). The impact of releasing hybrid partridges on wild red-legged populations. *Game Conservancy Review* of 1988: 81-85.
- Potts, G.R. (1992). Conservation through Wise-use hunting? Pp. 718-726 in: McCullough, D.R. & Barrett, R.H. eds. (1992). *Wildlife 2001: populations*. Elsevier, Essex, UK.
- Potts, G.R., Tapper, S.C. & Hudson, P.J. (1984). Population fluctuations in Red Grouse: analysis of bag records and a simulation model. *J. Anim. Ecol.* 53: 21-36.
- Powers, L.R. (1981). *Nesting Behavior of the Ferruginous Hawk (Buteo regalis)*. PhD thesis. Idaho State University, Pocatello, Idaho.
- Powers, L.R., Howard R. & Trost, C.H. (1975). Population status of the Ferruginous Hawk in southeastern Idaho and northern Utah. Pp. 153-157 in: Murphy, J.R., White, C.M. & Harrell, B.E. eds. (1975). *Population Status of Raptors*. Raptor Research Report 3. Raptor Research Foundation, Vermillion, South Dakota, USA.
- Prager, E.M. & Wilson, A.C. (1976). Congruency of phylogenies derived from different proteins. *J. Molec. Evol.* 9: 45-57.
- Prakash, V. (1994). Status, distribution and breeding biology of the Lesser Spotted Eagle in Keoladeo National Park. In: Meyburg & Chancellor (1994b).
- Prakash, V., Prakash, N.V. & Clark, W.S. (1993). Oriental Honey-buzzard *Pernis ptilorhynchus*: a new species for the Andaman Islands. *Forktail* 9: 156-157.
- Pramono, A.H. (1991). Maleo on Buton. *Kikila* 5(2): 150.
- Pratt, H.D. & Bruner, P.L. (1978). Micronesian Megapode rediscovered on Saipan. *Elepaio* 39: 57-59.
- Pratt, H.D., Bruner, P.L. & Berrett, D.G. (1979). America's unknown avifauna: the birds of the Mariana Islands. *Amer. Birds* 33: 227-235.
- Pratt, H.D., Bruner, P.L. & Berrett, D.G. (1987). *The Birds of Hawaii and the Tropical Pacific*. Princeton University Press, Princeton, New Jersey.
- Pratt, H.D., Engbring, J., Bruner, P.L. & Berrett, D.G. (1980). Notes on the taxonomy, natural history, and status of the resident birds of Palau. *Condor* 82: 117-131.
- Pré, M. (1981). Étude du chant du Tétras lyre (*Lyrurus tetrix*) à Corvières (Hautes-Alpes) au cours du printemps 1980. *Bull. mens. O.N.C.* (Dec. 1981): 185-212.
- Preston, C.R. & Beane, R.D. (1993). Red-tailed Hawk (*Buteo jamaicensis*). No. 52 in: Poole & Gill (1993).
- Prevost, A.Y. (1982). *The Wintering Ecology of Ospreys in Senegal*. PhD thesis, Edinburgh University.
- Prevost, A.Y. (1983). The moult of the Osprey. *Ardea* 71: 199-209.
- Price-Jones, H. (1983). *Australian Birds of Prey*. Doubleday, Sydney.
- Priddel, D. (1990). Conservation of the Malleefowl in New South Wales: an experimental management strategy. Pp. 71-74 in: Noble, J.C., Joss, P.J. & Jones, G.K. eds. (1990). *The Mallee Lands a Conservation Perspective*. CSIRO, Melbourne, Australia.
- Priddel, D. & Wheeler, R. (1990). Survival of Malleefowl *Leipoa ocellata* chicks in the absence of ground-dwelling predators. *Emu* 90: 81-87.
- Prigogine, A. (1973). Contribution à l'étude de la faune ornithologique de la région à l'ouest du lac Edouard. *Ann. Mus. Roy. Congo Belge (Ser. 8, Sci. Zool.)* 24: 1-117.
- Prigogine, A. (1976). Distribution de l'*Afrapara rufescens* Chapin. *Bull. Corps. Lieux. Hon. Chasse Congo Belge* 1(18): 249-252.
- Prigogine, A. (1971). Les oiseaux de l'ombrière et du sous-bois. *Mus. Roy. Afr. Cent. Ann. (Sér. 8)* 185.
- Prigogine, A. (1985). Recently recognised bird species in the Afrotropical Region - a critical review. Pp. 91-114 in: Schuchmann (1985).
- Prilkinsky, S.G. (1958). [On the downy plumage of Greater Spotted Eagle nestlings from observations in the Oka Reserve in 1954-1955]. *Trudy Olskogo gos. zapovednika* 2: 177-178. In Russian.
- Prilkinsky, S.G. (1960). [On the food of the Greater Spotted Eagle at the mouth of the Belaya River]. *Ornithologia* 3: 174-179. In Russian.
- Proud, D. (1949). Some notes on the birds of the Nepal valley. *J. Bombay Nat. Hist. Soc.* 48: 695-719.
- Prout-Jones, D.V. & Milstein, P.E. S. (1986). Sequential moult with age-class establishment in the African Fish Eagle *Haliaeetus vocifer*. *S. Afr. J. Wildl. Res.* 16: 17-26.
- Pruett-Jones, S.C., White, C.M. & Devine, W.R. (1981a). Breeding of the Peregrine Falcon in Victoria, Australia. *Ibis* 103: 283-289.
- Pruett-Jones, S.C., White, C.M. & Emison, W.B. (1981b). Egg-shell thinning and organochlorine residues in eggs and prey of Peregrine Falcons from Victoria, Australia. *Emu* 80: 282-287.
- Pruett-Jones, S.C., Pruett-Jones, M.A. & Knight, R.L. (1980). The White-tailed Kite in North and Middle America: current status and recent population changes. *Amer. Birds* 34: 682-688.
- Pulgeer, M. (1991). *Contribución al Conocimiento de la Biología y Evolución de la Colomita (Coturnix coturnix)*. PhD thesis. Publicacions Universitat de Barcelona, Spain.
- Pulgeer, M., Rodríguez-Tejedor, J.D. & Gallego, S. (1989). Migración y/o nomadismo en la codorniz *Coturnix coturnix*. *Ornithologia* 1: 39-45.
- Pulgeer, M., Rodríguez-Tejedor, J.D., Gallego, S. & Rodríguez-Rueda, F.J. (1991). Quasi *Coturnix c. coturnix* hunting in Spain: a preliminary assessment. *Trans. Congr. Internat. Union Game Biol.* 20(1): 345-322.
- Pujals, J.J., Wall, J.W. & Wilcove, D.S. (1977). First record of the Pearl Kite in Panama. *Amer. Birds* 31(6): 1099-1100.
- Pukinskii, J.B. & Nikanorov, A. (1974). [The Sharp-winged Grouse]. *Ochota i ochotni chozjajstvo* 7: 42-43.
- Pukinskii, Yu.B. (1966). [On the feeding of the Greater Spotted Eagle during the nestling period]. Pp. 125-127 in: *Materials of the VI Baltic Ornithological Conference*. In Russian.
- Pulliamen, E. (1985). On the sex determination and weight of the Willow Grouse (*Lagopus lagopus*) in Finnish Lapland. *Sammen Rista* 20: 43-49.
- Pulliamen, E. (1986). Composition and selection of winter food by Capercaillie (*Tetrao urogallus*) in northeastern Finnish Lapland. *Sammen Rista* 22: 67-73.
- Pulliamen, E. (1988). Winter nutrition of the Rock Ptarmigan *Lagopus mutus* (Montin) in northern Finland. *Ann. Zool. Fenn.* 7: 295-302.
- Pulliamen, E. (1978). Colour variation and sex identification in the Rock Ptarmigan (*Lagopus mutus*) in Finland. *Ann. Acad. Sci. Fenn. A IV Biol.* 160: 1-6.
- Pulliamen, E. (1980). Behaviour of a nesting Capercaillie (*Tetrao urogallus*) in northeastern Lapland. *Ann. Zool. Fenn.* 8: 456-462.
- Pulliamen, E. (1988). Structure of two Willow Grouse (*Lagopus lagopus*) populations in Finnish Lapland in the winters of 1972-1974. *Ann. Zool. Fenn.* 12: 263-267.
- Pulliamen, E. (1978). Behaviour of a Willow Grouse *Lagopus lagopus* at the nest. *Ornis Fenn.* 55: 141-148.
- Pulliamen, E. (1979). Autumn and winter nutrition of the Capercaillie (*Tetrao urogallus*) in the northern Finnish taiga. Pp. 92-97 in: Lovel (1979).
- Pulliamen, E. (1982a). Flocking behaviour of the Capercaillie (*Tetrao urogallus*) and conservation strategy for the species. Pp. 36-41 in: Lovel (1982).
- Pulliamen, E. (1982b). Breeding, foraging and wintering strategies of Black Grouse, *Lyrurus tetrix* L., in the Finnish taiga - a review. *Aquila Ser. Zool.* 21: 68-75.
- Pulliamen, E. (1984). Changes in the composition of the autumn food of *Perdix perdix* in west Finland over 20 years. *J. Appl. Ecol.* 21: 133-139.
- Pulliamen, E. (1986). Flocking of Capercaillie, *Tetrao urogallus*, in eastern Finnish Lapland in winter. *Ornis Fenn.* 63: 56-57.
- Pulliamen, E. & Iivanainen, J. (1981). Winter nutrition of the Willow Grouse (*Lagopus lagopus* L.) in the extreme north of Finland. *Ann. Zool. Fenn.* 18: 263-269.
- Pulliamen, E. & Tunkkari, P.S. (1983). Seasonal changes in the gut length of the Willow Grouse (*Lagopus lagopus*) in Finnish Lapland. *Ann. Zool. Fenn.* 20: 53-56.
- Pulliamen, E. & Tunkkari, P.S. (1991). Responses by the Capercaillie *Tetrao urogallus*, and the Willow Grouse *Lagopus lagopus*, to the green matter available in early spring. *Holarctic Ecol.* 14: 156-160.
- Pymönen, A. (1954). Beiträge zur Kenntnis der Lebensweise des Haselhühns *Tetrao bonasia* (L.). *Pap. Game Res.* 12: 1-90.
- Qadri, M.Y., Kaul, R. & Iqbal, M. (1990). Status of pheasants in Kashmir with special reference to endangered species. Pp. 124-127 in: Hill et al. (1990).
- Quednau, A. (1930). Schelladler am Mauereck. *Orn. Monatsber.* 38: 69-72.
- Quick, H. (1947). Winter food of White-tailed Ptarmigan in Colorado. *Condor* 49: 223-235.
- Quinn, N.W.S. & Keppie, D.M. (1981). Factors influencing growth of juvenile Spruce Grouse. *Can. J. Zool.* 59: 1790-1795.
- Quinto, J.F. (1981). Observaciones y reproducción de *Circus rubra* en condiciones seminaturales en San Felipe Baccalar, Quintana Roo, Mexico. Pp. 249-260 in: Estudillo López (1981).
- Quickán, A.M., Ramírez, E.M. & Thorstorn, R.K. (1992). Reproductive biology, food habits, and home range of the Bicolored Hawk. Pp. 163-168 in: Whitacre & Thorstorn (1992).
- Rabenold, P.P. (1986). Family associations in communally roosting Black Vultures. *Auk* 103: 32-41.
- Rabenold, P.P. (1987a). Recruitment to food in Black Vultures: evidence for following from communal roosts. *Anim. Behav.* 35: 1775-1785.
- Rabenold, P.P. (1987b). Roost attendance and aggression in Black Vultures. *Auk* 104: 647-653.
- Rabor, D.S. (1938). Birds from Leyte. *Phil. J. Sci.* 66: 15-34.
- Rabor, D.S. (1977). *Philippine Birds & Mammals*. University of the Philippines Press, Quezon City.
- Radke, E.L. & Klimosvski, J. (1977). Late fledging date for Harris' Hawk. *Wilson Bull.* 89: 469-470.
- Raethel, H.S. (1988). *Hühner Vogel der Welt*. Neumann-Neudamm, Helsingør, Germany.
- Ragless, G.B. (1958). Some notes on the Black-shouldered Kite. *S. Austr. Orn.* 22: 73-75.
- Rahbek, C., Bloch, H., Poulsen, M.K. & Rasmussen, J.F. (1989). *Zoologisk Museums ornithologiske ekspedition til Syamerika Andeshjerge 1989*. Zoological Museum, University of Copenhagen, Copenhagen.
- Rahmani, A.R. & Shobrak, M. (1993). Status and distribution of partridges in southwest Saudi Arabia. In: Jenkins (1993).
- Rahmani, A.R. & Qamar M. (1993). Status and distribution of Swamp Francolins in India. In: Jenkins (1993).
- Raiff, R.J. (1960). Breeding behavior in a population of California Quail. *Condor* 62: 284-292.
- Raiff, R.J. (1961). Plumage development and molts of California Quail. *Condor* 63: 294-303.
- Raiff, R.J. & Genelly, R.E. (1964). Dynamics of a population of California Quail. *J. Wildl. Manage.* 28: 127-141.
- Raiff, R.J. & Ohmart, R.D. (1966). Annual cycle of reproduction and moult in Gambel Quail of the Rio Grande Valley, southern New Mexico. *Condor* 68: 541-561.
- Raiff, R.J. & Ohmart, R.D. (1968). Sex and age ratios in Gambel Quail of the Rio Grande Valley, southern New Mexico. *Southwestern Naturalist* 13: 27-33.
- Rajala, P. (1974). The structure and reproduction of Finnish populations of Capercaillie, *Tetrao urogallus*, and Black Grouse, *Lyrurus tetrix*, on the basis of late summer census data from 1963-66. *Finnish Game Res.* 35: 1-51.
- Ramakka, J.M. & Woyewodzie, R.T. (1993). Nesting ecology of the Ferruginous Hawk in northwestern New Mexico. *J. Raptor Res.* 27: 97-101.
- Ramhariter, B.G. (1976). *Habitat Selection and Movements of Sharp-tailed Grouse (Pedioecetes phasianellus) Hens During the Nesting and Brood Rearing Periods in a Fire Maintained Brush Prairie*. PhD thesis, University of Minnesota, St. Paul.
- Ramos, M.A. (1985). Endangered tropical birds in Mexico and northern Central America. Pp. 305-318 in: Diamond & Lovejoy (1985).
- Rams, A. & Peña, C. (1988). Contribución al conocimiento del Gavilán Colilargo (*Accipiter gundlachi* ssp.) en la región norte de las provincias orientales. *Garciana* 13: 4.
- Rand, A.L. (1936). The distribution and habits of Madagascar birds: a summary of field notes of the Mission Zoologique Franco-Anglo-Américaine à Madagascar. *Bull. Amer. Mus. Nat. Hist.* 72: 143-499.
- Rand, A.L. (1942). Results of the Archbold Expeditions. No. 43. Birds of the 1938-1939 New Guinea expedition. *Bull. Amer. Mus. Nat. Hist.* 79: 425-515.
- Rand, A.L. (1951). Birds from Liberia. *Fieldiana Zool.* 32: 558-653.
- Rand, A.L. (1960). Races of the Short-tailed Hawk. *Auk* 77: 448-459.
- Rand, A.L. & Gilliard, E.T. (1967). *Handbook of New Guinea Birds*. Weidenfeld & Nicolson, London.
- Rand, A.L. & Rabor, D.S. (1960). *Birds of the Philippine Islands: Siquijor, Mount Malindang, Bohol and Samar*. Chicago Natural History Museum.
- Rand, A.L., Friedmann, H. & T aylor, M.A. (1959). Birds from Gabon and Moyen Congo. *Fieldiana Zool.* 41: 221-411.
- Randi, E., Alkon, P.U. & Meriggi, A. (1992). A new model of *Alectoris* evolution based on biochemical analysis. Pp. 661-666 in: Birkan, Potts et al. (1992).
- Randi, E., Fusco, G., Lorenzini, R. & Crowe, T.M. (1991). Phylogenetic relationships and rates of allozyme evolution within the Phasianidae. *Biochem. Syst. Ecol.* 19: 213-221.
- Randi, E., Meriggi, A., Lorenzini, R., Fusco, G. & Alkon, P.U. (1992). Biochemical analysis of relationships of Mediterranean *Alectoris* partridges. *Auk* 109: 358-367.
- Rands, M.R.W. (1985). Pesticide use on cereals and the survival of gamebird chicks: a field experiment. *J. Appl. Ecol.* 22: 49-54.
- Rands, M.R.W. (1986). The survival of gamebird (Galliformes) chicks in relation to pesticide use on cereals. *Ibis* 128: 57-64.
- Rands, M.R.W. (1988). The effect of nest site selection on nest predation in Grey Partridge *Perdix perdix* and Red-legged Partridge *Alectoris rufa*. *Ornis Scand.* 19: 35-40.
- Rands, M.R.W. (1992). The conservation status and priorities for threatened partridges, francolins and quails of the world. Pp. 493-502 in: Birkan, Potts et al. (1992).
- Rands, M.R.W. & Hayward, T.P. (1987). Survival and chick production of hand-reared Grey Partridges in the wild. *Wildl. Soc. Bull.* 15: 456-457.
- Rands, M.R.W., Rands, G. & Porter, R. (1987). *Birds in the Yemen Arab Republic*. Report of the Ornithological Society of the Middle East Expedition 1985. ICBP, Cambridge.
- Rands, M.R.W., Ridley, M.W. & Elliott, A.D. (1984). The social organization of feral peafowl. *Anim. Behav.* 32: 830-835.
- Rangel-Salazar, J.L. & Enriquez-Rocha, P.L. (1993). Nest record and dietary items for the Black Hawk-eagle (*Spizella tyrannus*) from the Yucatán Peninsula. *J. Raptor Res.* 27(2): 121-122.
- Rank, M. (1990). Brown Eared-pheasant found in suburbs of western Beijing. *Bull. Oriental Bird Club* 12: 11.
- Ransom, D., Rongstad, O.J. & Ruseh, D.H. (1987). Nesting ecology of Rio Grande Turkeys. *J. Wildl. Manage.* 51(2): 435-439.
- Rasa, O.A.E. (1986). Nocturnal group flights of the Pale Chanting Goshawk (*Melierax canorus poliopterus*) in the Tani Desert, Kenya. *Ostrich* 57: 191-192.
- Rasa, O.A.E. (1987). Patterns of intra-African small raptor spring migrations in the Tani Desert, Kenya. *Afr. J. Ecol.* 25: 165-171.
- Rasmussen, P.N., Stenroos, S. & Jensen, T.S. (1989). Populationsdynamik hos ægerhøne *Perdix perdix* i et konventionelt dykker landbrugsområde. *Flora og Fauna* 95: 51-59.
- Rasmussen, D.I. & Griner, L.A. (1938). Life history and management studies of the Sage Grouse in Utah, with special reference to nesting and feeding habits. *Trans. North Amer. Wildl. Nat. Resour. Conf.* 3: 852-864.
- Rasmussen, G. & Branden, R. (1973). Standard metabolic rate and lower critical temperature in the Kullfö Grouse *Wilson Bull.* 85: 223-229.
- Rasmussen, L.L. & Storgaard, K. (1989). The breeding of the Buzzard, Sparrowhawk, Goshawk, and Honey Buzzard in southeast Jutland, Denmark, 1973-1987. *Dan. Orn. Fenn. Tidsskr.* 83: 23-34. In Danish with English summary.
- Rasmussen, P., Humphrey, P.S. & Muniz-Suavedra, J. (1992). Imperial Shags and other birds of the Lago General Vinter area, Chubut Province, Argentina. *Oec. Pap. Mus. Nat. Hist. Univ. Kansas* (146): 1-16.

- Rasmussen, P.C. & López, N. (1988). Notes on the status of some birds of Región X, Chile. *Bull. Brit. Orn. Club* 108(4): 154-159.
- Ratcliffe, D. (1993). *The Peregrine Falcon*. T. & A. D. Poyser, London.
- Ratti, J.T., Mackey, D.L., & Aldredge, J.R. (1984). Analysis of Spruce Grouse habitat in north-central Washington. *J. Wildl. Manage.* 48: 1188-1196.
- Rautenbach, L.L., Fenton, M.B., Kemp, A.C., & van Jaarsveld, S.J. (1990). Home range and activity of African Goshawks *Accipiter taurus* in relation to their predation on bats. *Koedoe* 3: 17-22.
- Raxworthy, C.J., & Colston, P.R. (1992). Conclusive evidence for the continuing existence of the Madagascar Serpent Eagle *Eurostoichus astur*. *Bull. Brit. Orn. Club* 112: 108-111.
- Rea, A.M. (1973). The Scaled Quail (*Callipepla squamata*) of the Southwest: systematic and historical considerations. *Condor* 97: 322-329.
- Rea, A.M. (1980). Late Pleistocene and Holocene turkeys in the Southwest. *Contrib. Sci. Nat. Hist. Mus. Los Angeles County, California* 330: 209-224.
- Read, A. (1985). Predation of an arboreal rat by a New Zealand Falcon. *Notornis* 32: 155.
- Read, M. (1987). The Secretary Bird - aristocrat of the savannah. *Suana* 10: 13-14.
- Real, J. (1983). Dades sobre la biologia de l'Àliga cuabarrada (*Hieraaetus fasciatus* Vieill.) a la Serralada Pre-litoral Catalana. *Bulletin Inst. Catalana de Hist. Nat.* 49(Sec. Zool. 5): 127-141.
- Real, J. (1987). Evolución cronológica del régimen alimenticio de una población de *Hieraaetus fasciatus* en Catalunya: factores causantes, adaptación y efectos. Pp. 185-205 in: Baccetti & Spagnesi (1987).
- Real, J. (1991). *L'Àliga Perdiguera Hieraaetus fasciatus a Catalunya: Status, Ecologia Trifíca, Biologia Reproductiva i Demografia*. PhD thesis, Universitat de Barcelona, Spain.
- Real, J., & Mañosa, S. (1992). *La conservación de l'Àliga perdiguera a Catalunya*. Universitat de Barcelona, Spain.
- Redfield, J.A. (1973a). Demography and genetics in colonizing populations of Blue Grouse (*Dendragapus obscurus*). *Evolution* 27: 576-592.
- Redfield, J.A. (1973b). Variations of weight in Blue Grouse. *Condor* 75: 312-321.
- Redfield, J.A. (1975). Comparative demography of increasing and stable populations of Blue Grouse (*Dendragapus obscurus*). *Can. J. Zool.* 53: 1-11.
- Redfield, J.A. (1978). Growth of juvenile Blue Grouse *Dendragapus obscurus*. *Ibis* 120: 55-61.
- Redford, K.H. (1989). Mite Pascoal - Indigenous rights and conservation in conflict. *Oryx* 23: 33-36.
- Redhead, R.E. (1972). Armyworm (*Spodoptera exempta*) predation by Yellow-necked Sparrow (*Premisitis leucos cepus*) in the Longido Game Controlled Area. *East Afr. Wildl. J.* 10: 65-66.
- Redmond, G.W., Kipple, D.M., & Herzog, P.W. (1982). Vegetative structure, concealment, and success at nests of two races of Spruce Grouse. *Can. J. Zool.* 60: 670-675.
- Redpath, S.M. (1991). The impact of Red Harriers on Red Grouse breeding success. *J. Appl. Ecol.* 28: 659-671.
- Redpath, S.M. (1992). Behavioural interactions between Hen Harriers and their moorland prey. *Oryx* 28: 73-80.
- Reese, J. (1969). A Maryland Osprey population 75 years ago and today. *Maryland Birdlife* 25: 116-119.
- Reese, J. (1977). Reproductive success of Ospreys in central Chesapeake Bay. *Auk* 94: 202-221.
- Reichhoff, J. (1977). Long term and seasonal changes in the abundance of the Kestrel. *Am. Orn. Ges. Bayern* 16: 191-196. In German.
- Reid, S.B. (1989). Flying behaviour and habitat preferences of the King Vulture *Sarcorhamphus* sp. in the western Orinoco Basin of Venezuela. *Ibis* 131: 301-303.
- Reinhardt, R. (1989). Verwirrung um Glattschnabel- und Gelbschnabelhokkos. *Bongor, Berlin* 15: 127-128.
- Reise, O. (1907). Das Duenenjunge vom Kuttenger. *Vultur monachus* L. *Orn. Mschr.* 32: 331-333.
- Reistetter, R. (1991). Eine Felsenbrut des Schreitadlers *Aquila pomarina*. Pp. 265-270 in: Chancellor & Meyburg (1991).
- Reitz, F. (1989). Suivi des populations de Perdrix grises dans le Nord et le Bassin parisien en 1988. *Bull. mens. ONC* 131: 7-13.
- Reitz, F. (1992). Adult survival and reproductive success in abundant populations of Grey Partridge *Perdix perdix* in north-central France. Pp. 313-324 in: Birkan, Potts et al. (1992).
- Reitz, F., Buscari, L.A., & Pinet, J.M. (1984). Energy requirements of Grey Partridge *Perdix perdix* chicks determined by the daily labelled water method. *Gibier Faune Sauvage* 1: 91-108.
- Remington, T.E. (1989). Why do grouse have ceca? A test of the fiber digestion theory. *J. Exper. Zool. Suppl.* 3: 87-94.
- Remington, T.E. (1990). *Food Selection and Nutritional Ecology of Blue Grouse during Winter*. PhD thesis, University of Wisconsin, Madison.
- Rensen, J.V. (1985). Community organization and ecology of birds of the high elevation humid forest of the Bolivian Andes. Pp. 733-756 in: Buckley et al. (1985).
- Rensen, J.V., & Cardiff, S.W. (1990). Patterns of elevational and latitudinal distribution, including a "niche switch", in some guans (Cathartidae) of the Andes. *Condor* 92: 970-981.
- Rensen, J.V., & Ridgely, R.S. (1980). Additions to the avifauna of Bolivia. *Condor* 82(1): 69-75.
- Rensen, J.V., & Traylor, M.A. (1983). Additions to the avifauna of Bolivia, part 2. *Condor* 85(1): 95-98.
- Rensen, J.V., & Traylor, M.A. (1989). *An Annotated List of the Birds of Bolivia*. Buteo Books, Vermillion, South Dakota.
- Ren Jian-qiang & Hu Yue (1990). Habitat selection and feeding behaviour of the Brown Eared-pheasant. Page 78 in: Hill et al. (1990).
- Renard, F. (1988). Premières données sur le régime alimentaire hivernal du Tétraz lyre (*Tetrao tetrix*) dans les Hautes-Fagnes (Belgique). *Aves* 25: 1-15.
- Renard, F., & Schmitz, L. (1988). Observation de places de poudrage du Tétraz lyre (*Tetrao tetrix*) dans les Hautes-Fagnes. *Aves* 25: 61-63.
- Renjifo, L.M. (1988). *Composición y Estructura de la Comunidad Aviar de Bosque Andino Primario y Secundario en la Reserva del Alto Quindío "Acacine"*. Colombia. MSc Thesis, Universidad de Javeriana, Bogotá, Colombia.
- Rensell, J.A., & White, C.M. (1988). First description of hybrid Blue x Sage Grouse. *Condor* 90: 716-717.
- Renshaw, G. (1917). The Secretary Bird. *Aviduct, Mag.* 8: 334-341.
- Restani, M. (1989). Ferruginous Hawk *Buteo regalis*. Pp. 63-64 in: *Rare, Sensitive and Threatened Species of the Greater Yellowstone Ecosystems*.
- Rettig, N.L. (1977). In the nest of the snatcher. *Andean Mag.* 79: 26-49.
- Rettig, N.L. (1978). Breeding behavior of the Harpy Eagle. *Auk* 95(4): 629-643.
- Rettig, A. (1911). Der Mönchseiger. Seine Brutperiode 1911 in der Dobrudscha. *Mon. Vogelwelt* 11: 226-228.
- Reynold, E. (1987). Spatial visual acuity of the falcon *Falco berillonii*: a behavioural, optical and anatomical investigation. *Vision Research* 27: 1859-1874.
- Reynard, G.B., Short, L.L., Garrido, O.H., & Alayón, G. (1987). Nesting, voice, status and relationships of the endemic Cuban Gundlach's Hawk (*Accipiter gundlachi*). *Wilson Bull.* 99(1): 73-77.
- Reynolds, R.T. (1989). *Accipiters*. Pp. 92-101 in: Pendleton, B.G. ed. (1989). *Proceedings of the Western Raptor Management Symposium and Workshop*. National Wildlife Federation Science Technical Series 12. Washington, D.C.
- Reynolds, R.T., & Meslow, E.C. (1984). Partitioning of food and niche characteristics of coexisting *Accipiter* during breeding. *Auk* 101(4): 761-779.
- Reynolds, R.T., & Wight, H.M. (1978). Distribution, density and productivity of *Accipiter* hawks breeding in Oregon. *Wilson Bull.* 90: 182-196.
- Reynolds, R.T., Meslow, E.C., & Wight, H.M. (1982). Nesting habits of coexisting *Accipiter* in Oregon. *J. Wildl. Manage.* 46: 124-138.
- Rhodes, C. (1959). Nesting of the White-breasted Sea-Eagle. *Emu* 59: 221-222.
- Ricci, J. (1983). Le domaine vital de la Perdrix rouge (*Alectoris rufa*) dans le sud-ouest de la France: Dimensions sociales et spatiales. Pp. 293-308 in: *Actas del XV Congreso Internacional de Fauna Cinegética y Silvestre*. Estación Biológica de Doñana, Spain.
- Rice, S.M., Guthery, F.S., Spears, G.S., DeMaso, S.J., & Koerth, B.H. (1993). A precipitation-habitat model for Northern Bobwhites on semiarid rangeland. *J. Wildl. Manage.* 57: 92-102.
- Rieh, T. (1985). *Sage Grouse Population Fluctuations: Evidence for a 10-year Cycle*. US Bureau of Land Management, Technical Bulletin 1.
- Rich, T. (1993). Beacons in the Sage. *Birder's World* 7(4): 12-17.
- Richardson, C. (1990). *The Birds of the United Arab Emirates*. Hobby Publications, Dubai & Warrington.
- Richardson, P.R.K. (1984). The scavenging behaviour of vultures in southern Africa. Pp. 331-353 in: Ledger (1984).
- Richardson, P.R.K., Mundy, P.J., & Plug, I. (1986). Bone crushing carnivores and their significance to osteodontology in Griffon Vulture chicks. *J. Zool., London* 200: 23-43.
- Ridgely, R.S. (1980). *Black vultures in Malaya*. *Auk* 97: 55-56.
- Ridgely, R.S., & Platt, J.M. (1982). Status of the Black Vulture in Mallorca 1982. *Vulture News* 8: 11-18.
- Ridgely, R.S., & Stewart, J.G. (1975). The status of the Black Vulture (*Aegypius monachus*) in Mallorca. *Ardeola* 22(Special Vol.): 225-243.
- Ridgely, R.S. (1980). *Feeding of Red Goshawks in Costa Rica*. *Auk* 97: 55-56.
- Ridgely, R.S. (1983). *Birds collected by Dr W. I. Abbott and Mr C. B. Kloss in the Andaman and Nicobar Islands*. *Proc. US Natl. Mus.* 25: 287-314.
- Ridgely, R.S. (1979). The Kestrel in Ayrshire 1900-1978. *Scottish Birds* 10: 201-215.
- Ridgely, R.S., & Rennie, J.D. (1994). Use of the Saker and other large falcons in Middle East falconry. In: Meyburg & Chancellor (1994a).
- Ridgely, R.S. (1981). Notes on some rare or previously unrecorded birds in Ecuador. *Amer. Birds* 34: 242-248.
- Ridgely, R.S., & Gwynne, J.A. (1989). *A Guide to the Birds of Panama with Costa Rica, Nicaragua, and Honduras*. Princeton University Press, Princeton, New Jersey.
- Ridgway, R. (1875). Studies of the American Falconidae. Monograph of the genus *Microtus*. *Proc. Acad. Nat. Sci. Philadelphia* 3: 470-502.
- Ridgway, R. (1983). *On *Accipiter* grater*. *Proc. US Natl. Mus.* 36: 38.
- Ridgway, R., & Friedmann, H. (1946). *The Birds of North and Middle America, Part X: Crows to Melospiridae*. US National Museum Bulletin 50. Smithsonian Institution, Washington, D.C.
- Ridley, M.W. (1981). How did the peacock get his tail? *New Scientist* 91: 398-401.
- Ridley, M.W. (1983). *The Mating System of the Pheasant Phasianus colchicus*. PhD thesis, University of Oxford, UK.
- Ridley, M.W. ed. (1986). *Pheasants in Asia 1986*. Proceedings of the 3rd International Symposium on Pheasants in Asia held at Chiang Mai, Thailand, 26-28 January, 1986. World Pheasant Association, Reading, UK.
- Ridley, M.W. (1986b). Reintroducing pheasants to the wild: general policy. In: Ridley (1986a).
- Ridley, M.W. (1987). The relevance of social organisation to conservation in pheasants. Pp. 115-118 in: Savage & Ridley (1987).
- Ridley, M.W., & Hill, D.A. (1987). Social organisation in the Pheasant *Phasianus colchicus*: harem formation, mate choice and the role of mate guarding. *J. Zool., London* 211: 619-630.
- Ridley, M.W., & Islam, K. (1987). Report on Cheer Pheasant re-introduction project, Pakistan. Pp. 150-166 in: Savage & Ridley (1987).
- Ridley, M.W., Lelliott, A.D., & Rands, M.R.W. (1984). The courtship display of leral Peafowl. *J. World Pheasant Assoc.* 9: 57-68.
- Ridpath, M.G., & Brooker, M.G. (1986a). Age, movements and management of the Wedge-tailed Eagle, *Aquila audax*, in arid Western Australia. *Aust. Wildl. Res.* 13: 254-260.
- Ridpath, M.G., & Brooker, M.G. (1986b). The breeding of the Wedge-tailed Eagle *Aquila audax* in relation to its food supply in arid Western Australia. *Ibis* 128: 177-194.
- Ridpath, M.G., & Brooker, M.G. (1987). Sites and spacing of nests as determinants of Wedge-tailed Eagle breeding in arid Western Australia. *Emu* 87: 143-149.
- Rieger, L.G., & Walzthöny, D. (1992). The distribution of the Mountain Quail *Ophrysia superciliosa* in the last century. Pp. 585-590 in: Birkan, Potts et al. (1992).
- Rifai, A., & Soeharjo, M.B. (1976). *Metoda perbaikan habitat burung maleo (*Macropygia tenuirostris*) Mulleri di Tanjung Butok, Sulawesi Tenggara*. Unpublished report, Direktorat Perlindungan dan Pengawalan Alam, Bogor.
- Rijnsdorp, A., Daan, S., & Dijkstra, C. (1981). Hunting in the Kestrel, *Falco tinnunculus*, and the adaptive significance of daily habits. *Oecologia* 50: 391-406.
- Riley, J.H. (1938). Birds from Sum and the Malay Peninsula in the US National Museum collected by Dr Hugh M. Smith and William L. Abbott. *Bull. US Natl. Mus.* 172: 1-581.
- Riley, T.Z. (1978). *Nesting and Broad rearing Habitat of Lesser Prairie Chickens in Southeastern New Mexico*. MSc thesis, New Mexico State University, Las Cruces.
- Riley, T.Z., Davis, C.A., Ortiz, M., & Wisdom, M.J. (1992). Vegetative characteristics of successful and unsuccessful nests of Lesser Prairie Chickens. *J. Wildl. Manage.* 56: 383-387.
- Rimlinger, D.S. (1984a). Display behaviour of Temminck's Tragopan. *J. World Pheasant Assoc.* 9: 19-32.
- Rimlinger, D.S. (1984b). Observations on the display behaviour of the Bulwer's Pheasant. *J. World Pheasant Assoc.* 10: 15-27.
- Rimlinger, D.S., & Whitman, P. (1986). Observations on the breeding and behaviour of the Chinese Monal in captivity. In: Ridley (1986a).
- Rinke, D.R. (1986a). Notes on the avifauna of Niuafo'ou Island, Kingdom of Tonga. *Emu* 86: 82-86.
- Rinke, D.R. (1986b). The status of wildlife in Tonga. *Oryx* 20(3): 146-151.
- Rinke, D.R. (1991). Birds of 'Ata and Lale. Additional notes on the avifauna of Niuafo'ou, Kingdom of Tonga. *Notornis* 38: 131-151.
- Rintamaki, H., Saarela, S., Marjakangas, A., & Hissa, R. (1983). Summer and winter temperature regulation in the Black Grouse (*Lyrurus tetrix*). *Physiol. Zool.* 56: 152-159.
- Ripley, S.D. (1952). Vanishing and extinct bird species of India. *J. Bombay Nat. Hist. Soc.* 50: 902-906.
- Ripley, S.D. (1960). Distribution and niche differentiation in species of megapodes in the Moluccas and western Papan area. Pp. 631-640 in: *Proc. XII Internat. Orn. Congr. Helsinki, 1958*, Part 2.
- Ripley, S.D. (1964). *A Systematic and Ecological Study of Birds of New Guinea*. Peabody Museum of Natural History Yale University Bulletin 19. New Haven, Connecticut.
- Ripley, S.D. (1982). *A Synopsis of the Birds of India and Pakistan*. Bombay Natural History Society, Bombay.
- Ripley, S.D., & Bond, G.M. (1971). Systematic notes on a collection of birds from Kenya. *Smithsonian Contributions to Zoology* 111: 1-21.
- Ripley, S.D., & Heinrich, G.H. (1966). Additions to the avifauna of northern Angola II. *Psittalia* 95: 1-29.
- Rippin, A.P., & Boag, D.A. (1974a). Recruitment to populations of male Sharp-tailed Grouse. *J. Wildl. Manage.* 38: 616-621.
- Rippin, A.P., & Boag, D.A. (1974b). Spatial organization among male Sharp-tailed Grouse on arenas. *Can. J. Zool.* 52: 591-597.
- Risebrough, R.W., Schlorff, R.W., Bloom, P.H., & Litell, E.E. (1989). Investigations of the decline of Swainson's Hawk in California. *J. Raptor Res.* 23: 63-71.
- Risebrough, R.W., Springer, A.M., Temple, S.A., White, C.M., & Albuquerque, J.L.B. (1990). Observaciones del Halcón peregrino, *Falco peregrinus* subsp., en America del Sur. *Rev. Brasil Biol.* 50: 563-574.
- Ristow, D. (1975). Neue Ringfunde vom Eleonorenfalken (*Falco eleonorae*). *Die Vogelwarte* 28: 150-153.
- Ristow, D., & Wink, M. (1985). Breeding success and conservation management of Eleonora's Falcon. Pp. 147-152 in: Newton & Chancellor (1985).
- Ristow, D., Scharlau, M., & Wink, M. (1989). Population structure and mortality of Eleonora's Falcon *Falco eleonorae*. Pp. 321-326 in: Meyburg & Chancellor (1989).
- Ristow, D., Wink, C., & Wink, M. (1979). Site tenacity and pair bond of the Eleonora's Falcon, *H. Meril* 20: 16-18.
- Ristow, D., Wink, C., & Wink, M. (1982). Biology of Eleonora's Falcon (*Falco eleonorae*): 1. Individual and social defense behavior. *J. Raptor Res.* 16: 65-70.
- Ristow, D., Wink, C., & Wink, M. (1983). Biologie des Eleonorenfalken (*Falco eleonorae*): 1. Die Anpassung des Jagdverhaltens an den Wind Abhängigkeit Ringvogelhaftigkeiten. *J. Orn.* 31: 7-13.
- Ristow, D., Wink, M., Wink, C., & Friemann, H. (1983). Biologie des Eleonorenfalken (*Falco eleonorae*): 14. Das Brutverhalten der Weibchen. *J. Orn.* 124: 291-293.
- Ritchie, R.J. (1982). Investigations of Bald Eagles, Tanana River, Alaska, 1977-80. Pp. 55-67 in: Ladd, W.N. & Schenkel, P.F. eds. (1982). *Proceedings of a Symposium and Workshop, Raptor Management and Biology in Alaska and Western Canada*. US Fish & Wildlife Service, Anchorage, Alaska.
- Rivera, J.M.C., & Córdova, G.G. (1992). Reproductive biology and food habits of the Collared Forest falcon in Tikal National Park. Pp. 209-215 in: Whittaker & Thorstorn (1992).
- Rivera-Rodriguez, L., & Rodriguez-Estrella, R. (1993). Breeding ecology of the Crested Caracara (*Polyborus planci*) in the Cape Region, Baja California S., Mexico. *J. Raptor Res.* 27(1): 91-92.
- Rivoire, A., & Húe, F. (1949). L'Angle de Bonelli. *Oiseau et RFO* 19: 118-149.
- Robb, L.A., Martin, K., & Hannon, S.J. (1992). Spring body condition, fecundity and survival in female Willow Ptarmigan. *J. Anim. Ecol.* 61: 215-223.
- Robbins, G.E.S. (1981). *Quail: their Breeding and Management*. World Pheasant Association, Suffolk, UK.
- Robbins, G.E.S. (1984). *Partridges: their Breeding and Management*. World Pheasant Association, Suffolk, UK.
- Robbins, G.E.S. (1987). The captive breeding of partridges, quail and francolin. In: *Conservation of Game Birds* (ed. 1992).
- Robbins, M.B., & Ridgely, R.S. (1990). The avifauna of an upper tropical cloud forest in southwestern Ecuador. *Proc. Nat. Acad. Sci.* 142: 59-71.
- Robbins, M.B., Capparella, A.P., Ridgely, R.S., & Cardiff, S.W. (1991). Avifauna of the Rio Manu and Quebrada Vanilla, Peru. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robbins, M.B., Parker, T.A., & Allen, S.A. (1988). The avifauna of Cerro Torre, Dainton, Ecuador. Pp. 188-232 in: Buckley et al. (1988).
- Robbins, M.B., Ridgely, R.S., Schulenberg, T.S., & Gill, F.B. (1987). The avifauna of the Cordillera de Cacha, Ecuador, with comparisons to other Andean localities. *Proc. Acad. Nat. Sci. Philadelphia* 139(1): 243-260.
- Robel, R., & Arruda, S.M. (1986a). Energetics and weight changes of Northern Bobwhites fed six different foods. *J. Wildl. Manage.* 50: 236-248.
- Robel, R.J. (1986). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986b). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986c). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986d). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986e). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986f). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986g). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986h). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986i). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986j). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986k). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986l). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986m). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986n). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986o). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986p). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986q). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986r). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986s). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986t). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986u). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986v). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986w). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986x). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986y). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.
- Robel, R.J. (1986z). *Avifauna of the Rio Manu and Quebrada Vanilla, Peru*. *Proc. Acad. Nat. Sci. Philadelphia* 143: 145-159.

- Robel, R.J. (1967). Significance of booming grounds of Greater Prairie Chickens. *Proc. Amer. Philos. Soc.* 111: 109-114.
- Robel, R.J. (1969a). Nesting activities and brood movements of Black Grouse in Scotland. *Ibis* 111: 395-399.
- Robel, R.J. (1969b). Movements and flock stratification within a population of Blackcocks in Scotland. *J. Anim. Ecol.* 38: 385-393.
- Robel, R.J. (1970). Possible role of behavior in regulating Greater Prairie Chicken populations. *J. Wildl. Manage.* 34: 306-312.
- Robel, R.J. (1972). Possible function of the lek in regulating tetraonid populations. Pp. 121-133 in: *Proc. XV Int. Orn. Congr., the Hague, 1970*.
- Robel, R.J. & Ballard, W.B. (1974). Lek social organization and reproductive success in the Greater Prairie Chicken. *Amer. Zool.* 14: 121-128.
- Robel, R.J. & Fretwell, S.D. (1970). Winter mortality of Bobwhite Quail estimated from age ratio data. *Trans. Kansas Acad. Sci.* 73: 361-367.
- Robel, R.J., Briggs, J.N., Cebalá, J.J., Silvey, N.J., Viers, C.E., & Watt, P.G. (1970). Greater Prairie Chicken ranges, movements, and habitat usage in Kansas. *J. Wildl. Manage.* 34: 286-306.
- Robertis, A. (1929). New forms of African birds. *Ann. Transvaal Mus.* 13: 71-81.
- Robertis, A. (1940). *The Birds of South Africa*. Witherby, London.
- Robertis, A. (1947). A new *Pternistis* from Salisbury, S. Rhodesia. *Ostrich* 18: 197.
- Robertis, T.J. (1991). *The Birds of Pakistan*. Vol. 1. Non-Passeriformes. Oxford University Press, Karachi.
- Robertson, A.S. (1986). Notes on the breeding cycle of Cape Vultures (*Gyps caprotheres*). *J. Raptor Res.* 20: 51-60.
- Robertson, A.S. & Boshoff, A.F. (1986). The feeding ecology of Cape Vultures *Gyps caprotheres* in a stock-farming area. *B. A. E. Ornithol.* 15: 1-10.
- Robertson, A.S. & February, E. (1986). Towards an historical perspective of Cape Vultures and domestic stock: a view from the southwestern Cape. *Vulture News* 15: 4-6.
- Robertson, C.J.R. (1985). *Reader's Digest Complete Book of New Zealand Birds*. Reader's Digest, Sydney.
- Robertson, G. (1987). Effects of a drought on a breeding population of Wedge-tailed Eagles *Aquila audax*. *Emu* 87: 220-223.
- Robertson, J. (1932). Minutes of Cooper Club meetings, Southern Div. *Condor* 34: 109.
- Robertson, P. (1991). Wild and reared pheasants: liaison between Chinese and British biologists. *World Pheasant Assoc. News* 31: 17-18.
- Robertson, P. (1990). The effects of releasing hand-reared birds on the British pheasant population. Pp. 233-236 in: Hill et al. (1990).
- Robertson, P. & Carroll, J. (1989). Observations on the autumn densities of Chinese Ring-necked Pheasants in Shanxi Province. *J. World Pheasant Assoc.* 14: 101-106.
- Robertson, P.A. & Dowell, S.D. (1990). The effects of hand-rearing on wild gamebird populations. Pp. 158-171 in: Lumley, J.T. & Hoogeveen, Y.R. eds. (1990). *De toekomst van de wilde hoenderachtigen in Nederland*. ONWIL, Amerfoort, Netherlands.
- Robertson, W.R.B., Bohren, B.B., & Warren, D.C. (1943). The inheritance of plumage color in the Turkey. *J. Heredit.* 34: 246-256.
- Rohlf, E., Gertsner, R., & Trogisch, K. (1985). Naturbrut von Halsbandtalegalla order Jobi-maleo *Talegalla phoenicea* Meyer, 1874. *Gefiederte Welt* 109: 214-216.
- Robinson, A.C., Cusperman, K.D., & Copley, P.B. (1990). Breeding records of the Malleefowl (*Leipoa ocellata*) and Scarlet-chested Parrots (*Neophema splendida*) within the Yellabinnia Wilderness Area, South Australia. *S. Austr. Orn.* 31: 8-12.
- Robinson, H.C. (1913). Notes of birds new to, or rare in, the Malay Peninsula. *J. Fed. Malay States Mus.* 5: 15-22.
- Robinson, H.C. (1915a). The Birds of south-west and Penninsular Siam. *J. Nat. Hist. Soc. Siam* 5: 718-761.
- Robinson, H.C. (1915b). On a collection of birds from the Siamese Province of Bandon. *J. Fed. Malay States Mus.* 5: 83-110.
- Robinson, H.C. & Chasen, F.N. (1936). *The Birds of the Malay Peninsula*. Vol. III. *Sporting birds: Birds of the Shore and Estuaries*. Witherby, London.
- Robinson, H.C. & Kloss, C.B. (1918). Results of an expedition to Korinchi Peak, Sumatra. *Birds. J. Fed. Malay States Mus.* 8: 81-284.
- Robinson, H.C. & Kloss, C.B. (1921). The birds of south-west and Peninsular Siam. *J. Nat. Hist. Soc. Siam* 5: 1-397.
- Robinson, H.C. & Kloss, C.B. (1924). On a large collection of birds chiefly from West Sumatra made by Mr E. Jacobson. *J. Fed. Malay States Mus.* 11: 89-349.
- Robinson, H.C., Kloss, C.B., Boulenger, G.A., & Regan, C.T. (1918). Results of an expedition to Korinchi Peak, Sumatra. *J. Fed. Malay States Mus.* 8: 81-284.
- Robinson, W. (1950). Montagu's Harrier *Bird Notes* 24: 103-114.
- Robinson, W.L. (1969). Habitat selection by Spruce Grouse in northern Michigan. *J. Wildl. Manage.* 33: 113-120.
- Robinson, W.L. (1980). *Fool Hen: the Spruce Grouse on the Yellow Dogs Plains*. University of Wisconsin Press, Madison.
- Robinson, W.L. ed. (1984). *Ruffed Grouse Management: State of the Art in the early 1980's*. Book Crafters, Michigan.
- Robson, C.R. (1986). Recent observations of birds in Xizang and Qinghai provinces, China. *Forktail* 2: 67-82.
- Robson, C.R. (1990). Recent report: Thailand. *Bull. Oriental Bird Club* 12: 42-43.
- Robson, C.R., Eames, J.C., Newman, M., Nguyen Cu & Truong Van La (1991). *Vietnam Forest Project Bird Surveys 1989/90: Final Report*. Unpublished report to ICBP, Cambridge.
- Robson, C.R., Eames, J.C., Nguyen Cu & Truong Van La (1993a). Birds recorded during the BirdLife/Forest Birds Working Group expedition in Vietnam. *Forktail* 9: 89-119.
- Robson, C.R., Eames, J.C., Nguyen Cu & Truong Van La (1993b). Further records of birds from Vietnam. *Forktail* 8: 25-52.
- Robson, C.R., Eames, J.C., Wolstencroft, J.A., Nguyen Cu & Truong Van La (1989). Recent records of birds from Vietnam. *Forktail* 5: 71-97.
- Rocamora, G. (1994a). Bonelli's Eagle. In: Tucker, G., Heath, M.F., Tomialoj, L., & Grimmett, R.F.A. (1994). *Birds in Europe: their Conservation Status*. Bird Conservation Series. BirdLife International, Cambridge.
- Rocamora, G. (1994b). Short-toed Eagle. In: Tucker, G., Heath, M.F., Tomialoj, L., & Grimmett, R.F.A. (1994). *Birds in Europe: their Conservation Status*. Bird Conservation Series. BirdLife International, Cambridge.
- Rockenbach, D. (1968). Zur Brutbiologie des Turmfalken (*Falco tinnunculus* L.). *Anz. Orn. Ges. Bayern* 8: 1-10.
- Rockenbach, D. (1975). Zwölfjährige Untersuchungen zur Ökologie des Mäusebussard (*Buteo buteo*) auf des Schwäbischen Alb. *J. Orn.* 116: 39-54.
- de Roder, F.E. (1989). The migration of raptors south of Annapurna, Nepal, autumn 1985. *Forktail* 4: 9-17.
- Rodewald, P.G., DeJaffre, P.A., & Green, A.A. (1994). The birds of Korup National Park and Korup Project Area, Southwest Province, Cameroon. *Bird Conserv. Int.* 4: 1-68.
- Rodgers, J.A., Schiwert, S.T., & Wenner, A.S. (1988). Status of the Snail Kite in Florida: 1981-1985. *Amer. Birds* 42(1): 30-35.
- Rodgers, R.D. (1992). A technique for establishing Sharp-tailed Grouse in unoccupied range. *Wildl. Soc. Bull.* 20: 101-106.
- Rodionov, M.A. (1963). [On the biology of the Hazel Hen in Leningrad region]. *Uchenye zap. Leningradskogo gos. ped. inst.* 230: 139-165. In Russian.
- Rodionov, M.A. (1966). [Data on the biology and ecology of the Black Grouse in Leningrad region]. Pp. 135-137 in: *Mat. VI Prikl. orn. konf.* Vilnius. In Russian.
- Rodionov, M.A. (1969). [On the biology of the Willow Grouse in Leningrad region]. Pp. 37-78 in: *Ezhegodnik obshchestva etnografistov*, Tallin.
- Rodriguez, J.V. (1982). *Atenas del Parque Nacional Los Katlos*. INDERENA, Bogotá.
- Rodriguez-Duran, A., & Lewis, A.R. (1985). Seasonal predation by Merlins on Sooty Moustached Bats in western Puerto Rico. *Biological* 17: 71-74.
- Rodriguez-Estrella, R. (1990). Density and habitat use of raptors along the Rio Bavispse and Rio Yagui, Sonora, Mexico. *J. Raptor Res.* 24(3): 47-51.
- Rodriguez-Estrella, R. & Brown, B.T. (1990). Species richness and determination of the diversity of raptors in the Yagui and Bavispse Rivers in Sonora, Mexico. *Acta Zool. Mex. Nueva Ser.* 4(1): 1-17.
- Rodriguez-Estrella, R. & Rivera-Rodriguez, L. (1992). Kleptoparasitism and other interactions of the Cicad and Caceraca in the Cape region, Baja California, Mexico. *J. Field Orn.* 63(2): 177-180.
- Rodriguez-Estrella, J.D., Borgeguez, M., & Cornejo, S. (1992). Mating strategy in the European Chaffinch (*Fringilla coelebs*) revealed by male population density and sex ratio. Pp. 377-386 in: Birkan, P. et al. (1992).
- Rodzieviewicz, M. (1994). The status, range and breeding success of the Lesser Spotted Eagle *Aquila pomarina* in Poland. In: Meyburg & Chancellor (1994b).
- Roes, A.J. (1992). Notes on the American Sparrowhawk. *Avia* 74: 1-19.
- Rogacheva, H. (1992). *The Birds of Central Siberia*. Husum-Druck und Verlagsgesellschaft, Husum, Germany.
- Rogers, G.E. (1964). *Sage Grouse Investigations in Colorado*. Game Research Division Technical Publication 16. Colorado Game, Fish and Parks Department.
- Rogers, G.E. (1968). *The Blue Grouse in Colorado*. Game Research Division Technical Publication 21. Colorado Game, Fish and Parks Department.
- Rogers, G.E. (1969). *The Sharp-tailed Grouse in Colorado*. Game Research Division Technical Publication 23. Colorado Game, Fish and Parks Department.
- Roles, D.G. (1973). Breeding the Red-necked Francolin. *Pternistis offer* at the Jersey Wildlife Preservation Trust. *Avicult. Mag.* 79: 204-207.
- Roles, D.G. (1990). *Rare Pheasants of the World*, 2nd. edition. Spur Publications, Liss, UK.
- Rolstad, J. (1988). Autumn habitat of Capercaillie in southeastern Norway. *J. Wildl. Manage.* 52: 747-753.
- Rolstad, J. (1989). *Habitat and Range Use of Capercaillie Tetrao urogallus L. in Southcentral Scandinavian Boreal Forests, with Special Reference to the Influence of Modern Forestry*. DAGr thesis, Agricultural University of Norway, As, Norway.
- Rolstad, J. & Wegge, P. (1987). Habitat characteristics of Capercaillie *Tetrao urogallus* display grounds in southeastern Norway. *Holarctic Ecol.* 10: 219-229.
- Rolstad, J. & Wegge, P. (1988). Capercaillie habitat: a critical assessment of the role of old forest. Pp. 235-250 in: Lovel & Hudson (1988).
- Rolstad, J. & Wegge, P. (1989a). Effects of logging on Capercaillie (*Tetrao urogallus*) leks. I. Cutting experiments in southeastern Norway. *Scand. J. For. Res.* 4: 99-110.
- Rolstad, J. & Wegge, P. (1989b). Effects of logging on Capercaillie (*Tetrao urogallus*) leks. II. Cutting experiments in southeastern Norway. *Scand. J. For. Res.* 4: 111-127.
- Rolstad, J. & Wegge, P. (1989c). Effects of logging on Capercaillie (*Tetrao urogallus*) leks. III. Extinction and recolonization of lek populations in relation to clearfelling and fragmentation of old forest. *Scand. J. For. Res.* 4: 129-135.
- Rolstad, J. & Wegge, P. (1989d). Capercaillie *Tetrao urogallus* populations and modern forestry: a case for landscape ecological studies. *Finnish Game Res.* 46: 43-52.
- Rolstad, J., Wegge, P., & Gjerde, I. (1991). Cumulative impact of habitat fragmentation: lessons from 12 years of Capercaillie research at Varaldskogen, Norway. *Fauna, Oslo* 44: 90-104.
- Rolstad, J., Wegge, P., & Larsen, B.B. (1988). Spacing and habitat use of Capercaillie during summer. *Can. J. Zool.* 66: 670-679.
- Romanov, A.N. (1963). [On the ecology of the Hazel Hen in Komi ASSR]. *Trudy Komi fl. Akad. Nauk SSSR* 12: 79-86. In Russian.
- Romanov, A.N. (1979). *Obyknovennyy gluchar' [The Capercaillie]*. Leningrad.
- Romero-Zambrano, H. (1983). Revisión del estado zootaxo geográfico y redescrípción de *Odontophorus streptopium* (Gould) (Aves: Phasianidae). *Caldasia* 13(65): 777-786.
- Rong Rong, L.C. (1984). The Imperial Pheasant *Symaticus mikado* of Taiwan and Lai Yun-xing. *Nature* (2): 19-20.
- Rooskanger, L.C. (1989). *The Zoological Exploration of Southern Africa, 1650-1790*. A.A. Balkema, Rotterdam.
- Root, T. (1988). *Atlas of Wintering North American Birds. An Analysis of Christmas Bird Count Data*. The University of Chicago Press, Chicago & London.
- Roper, D.S. (1983). Egg incubation and laying behaviour of the Incubator Bird *Megapodius freycinet* on Savo. *Ibis* 125: 384-389.
- Roppe, J.A., Siegel, S.M., & Wilder, S.E. (1989). Prairie Falcon nesting on transmission towers. *Condor* 91: 711-712.
- Rorvik, K.A., Pedersen, H.C., & Steen, J.B. (1990). Genetic variation and territoriality in Willow Ptarmigan (*Lagopus lagopus lagopus*). *Evolution* 44: 1490-1497.
- Roseberry, J.L. & Klimstra, W.D. (1984). *Population Ecology of the Bobwhite*. Southern Illinois University Press, Carbondale.
- Roseberry, J.L. & Klimstra, W.D. (1992). Further evidence of differential harvest rates among Bobwhite sex-age groups. *Wildl. Soc. Bull.* 20: 91-94.
- Rosene, W. (1969). *The Bobwhite Quail: its Life and Management*. Rutgers University Press, New Brunswick, New Jersey.
- Roseneau, D.G. (1972). *Summer Distribution, Numbers and Food Habits of the Gyrfalcon (Falco rusticolus) on the Seward Peninsula, Alaska*. MSc thesis, University, Fairbanks, Alaska.
- Rosenfeld, R.N. (1978). Attacks by nesting Broad-winged Hawks. *Passenger Pigeon* 40: 419.
- Rosenfeld, R.N. (1984). Nesting ecology of Broad-winged Hawks in Wisconsin. *J. Raptor Res.* 18: 6-9.
- Rosenfeld, R.N. (1990). *Pre-incubation Behavior and Paternity Assurance in the Cooper's Hawk (Accipiter cooperii) (Bonaparte)*. PhD thesis, North Dakota State University, Fargo.
- Rosenfeld, R.N. & Bielefeldt, J. (1993). Cooper's Hawk (*Accipiter cooperii*). No. 75 in: Poole & Gill (1993).
- Rosenfeld, R.N., Bielefeldt, J., Anderson, R.K., & Papp, J.M. (1991). Accipiters. Pp. 42-49 in: Pendleton, B.G. & Kuabe, D.L. eds. (1991). *Proceedings of the 1982 Raptor Management Symposium and Workshop*. National Wildlife Federation Technical Publication 15. Washington, D.C.
- Rosenfeld, R.N., Gratson, M.W., & Carson, L.B. (1984). Food brought by Broad-winged Hawks to a Wisconsin nest. *J. Field Orn.* 55: 246-247.
- Rosenthal, M. (1992). Talking turkey. A photo essay on America's Wild Turkey. *Birds' World* 6(6): 36-41.
- Rosliakov, G.E. (1988). [The number and distribution of Steller's Sea Eagle in Khabarovsk territory in winter 1986. The First International census]. Page 122 in: Litvinenko (1988). In Russian.
- Ross, T., Olsen, P.D., Olsen, J., & Metcalfe, R. (1989). Incubation period of the Collared Sparrowhawk *Accipiter cirrocephalus*. *Austr. Bird Watcher* 13: 59-61.
- van Rossem, A.J. (1934a). Critical notes on Middle American birds. *Bull. Mus. Comp. Zool.* 77: 387-490.
- van Rossem, A.J. (1934b). Two new races of the Black Chachalaca from Central America. *San Diego Soc. Nat. Hist.* 7(31): 363-365.
- van Rossem, A.J. (1937). A review of the races of the Mountain Quail. *Condor* 39: 20-24.
- van Rossem, A.J. (1942). Systematic position of *Oreallus wagleri*. *Condor* 44: 77-78.
- van Rossem, A.J. (1945). A distributional survey of the birds of Sonora, Mexico. *Occ. Pap. Mus. Zool. Louisiana State Univ.* 21.
- Roth, S.D. & Marzluff, J.M. (1989). Nest placement and productivity of Ferruginous Hawks in western Kansas. *Trans. Kansas Acad. Sci.* 92: 132-148.
- Rothfels, M. & Lein, M.R. (1983). Territoriality in sympatric populations of Red-tailed and Swainson's Hawks. *Can. J. Zool.* 61: 60-64.
- Round, P.D. (1988). *Resident Forest Birds in Thailand: their Status and Conservation*. ICBP Monograph 2. Cambridge.
- Round, P.D. (1989). Silver Pheasant. *World Pheasant Assoc. News* 23: 30-32 (Reprinted from Bangkok Bird Club Bulletin).
- Round, P.D. (1990). Rain Quail. *World Pheasant Assoc. News* 27: 23-24. (Reprinted from Bangkok Bird Club Bulletin, 6 September 1989).
- Roussel, Y.E. & Ouellet, R. (1975). A new criterion for sexing Quebec Ruffed Grouse. *J. Wildl. Manage.* 39: 443-445.
- Rowe, E.G. (1947). The breeding biology of *Aquila verreauxii* Lesson. *Ibis* 89: 387-410.
- Rowley, L. (1975). The Malleefowl *Leipoa ocellata*. Pp. 131-144 in: Rowley, L. (1975). *Bird Life*. Australian Naturalist Library, Collins, Sydney & London.
- Rowley, J.S. (1966). Breeding records of the birds of the Sierra Madre del Sur, Oaxaca, Mexico. *Proc. West. Found. Vert. Zool.* 1: 107-204.
- Rowley, J.S. (1984). Breeding records of land birds in Oaxaca, Mexico. *Proc. West. Found. Vert. Zool.* 2: 73-224.
- Rozanov, M.P. (1931). The breeding of the Black Vulture (*Argyrops monachus* L.) on Crimea. Pp. 90-95 in: *[Shornik rabot na Evropejskij fauny Krymskogo gos. zapovednika]*. In Russian.
- Rozendaal, F.G., & Dekker, R.W.R.J. (1989). Annotated checklist of the birds of the Dumaga-Bone National Park, North Sulawesi. *Kukila* 4(3-4): 85-109.
- Rozendaal, F.G., & Nguyen Cu (1991). Notes on Vietnamese Pheasant with descriptions of the female plumage of *Lophura batiniensis*. *Dutch Birding* 13: 12-15.
- Ruan Xian-dong, Lin Hong & Cheng Chui-yun (1993). Study on the breeding behaviour of the Chinese Monal in captivity. *J. World Pheasant Assoc.* 17(18): 25-36.
- Rudolph, D.C. & Fisher, C.D. (1993). Swainson's Hawk predation on dragonflies in Argentina. *Wilson Bull.* 105: 365-366.
- Rudolph, S.G. (1982). Foraging strategies of American Kestrels during the breeding season. *Ecology* 63: 1268-1276.
- Rudolph, S.G., Kuhlman, A., & Minton, M. (1985). Breeding raptors in Portugal: distribution and population estimates. Pp. 15-27. Newton & Chancellor (1985).
- Ruschi, D.E. (1987). *Population Dynamics, Habitat Use and Movement Patterns of the Prairie Falcon (Falco mexicanus)*. PhD thesis, University of Wyoming, Laramie.
- Ruschi, D.E. & Anderson, S.A. (1986). Characteristics of cliff and nest sites used by breeding Prairie Falcon. *J. Raptor Res.* 20: 21-28.
- Rusch, D.H. & Doerr, P.D. (1972). Broad-winged Hawk nesting and food habits. *Auk* 89: 139-145.
- Rusch, D.H. & Keith, L.B. (1971). Ruffed Grouse - vegetation relationships in central Alberta. *J. Wildl. Manage.* 35: 417-429.
- Ruschi, A. (1979). *Aves do Brasil*. Editora Rios, São Paulo.

- Ruschi, A. & Amadon, D. (1959). A supposed hybrid between the families Numididae and Cracidae. (*Proc. I Pan-Afr. Orn. Congr.*) *Ostrich* 3(Suppl.): 440-442.
- Russell, R.W. (1991). Nocturnal flight by migrant "diurnal" raptors. *J. Field Orn.* 62(4): 505-508.
- Russell, S.M. (1964). *A Distributional Study of the Birds of British Honduras*. Ornithological Monographs 1. American Ornithologists' Union.
- Russell, T.P. (1932). *The Scaled Quail of New Mexico*. MSc thesis, University of New Mexico, Albuquerque.
- Rutgers, A. & Norris, K.A. (1970). *Encyclopedia of Aviculture*. Blandford Press, London.
- Ryabov, V.F. (1969). [Feeding biology of the Steppe Eagle and Long-legged Buzzard in northwestern Kazakhstan]. Pp. 551-554 in: *Ornithology in the USSR*, Ashkhabad, "Ylym". In Russian.
- Ryabtsev, V.V. (1989). [On factors influencing the breeding efficiency of the Imperial Eagle in the area west of Lake Baikal]. *Ecology* 5: 63-67. In Russian.
- Rymon, L.M. (1989). The restoration of Ospreys to breeding status in Pennsylvania by hacking (1980-1986). Pp. 359-362 in: Meyburg & Chancellor (1989).
- Sæther, T. (1989). A new taxonomic approach to the Norwegian island Willow Grouse *Lagopus lagopus variegatus*. *Fauna Norvegica (Ser. C. Cinclus)* 12: 79-99.
- Sahin, R. (1984). Zur Balz des Mikado-Fasans (*Symantacus mikado*) in Gefangenschaft. *J. Orn.* 125: 15-23.
- Saklani, A.C., Singh, U., Lakhera, P., Bhatt, D. & Pant, K. (1990). Field observations on behavioural ecology of the White-crested Kalij Pheasant in Garhwal Himalaya, India. Pp. 188-192 in: Hill *et al.* (1990).
- Sakurai, N. (1972). [Fluctuations of body weight and clutch size in rare *Lagopus mutus japonicus* Clark]. Pp. 141-159 in: (the Japanese) Parnigian, Tokyo. In Japanese.
- Sakurai, N. & Tsuruta, S. (1972). [Population studies of Japanese Parnigian (*Lagopus mutus japonicus* Clark) in the Muroda area, Tateyama, Japan Alps, from 1967 to 1969]. Pp. 184-215 in: (the Japanese) Parnigian, Tokyo. In Japanese.
- Salo, L.J. (1971). Autumn and winter diet of the Hazel Grouse (*Tetrastes bonasia* L.) in northeastern Finnish Lapland. *Ann. Zool. Fenn.* 8: 543-546.
- Salo, L.J. (1978). Characteristics of Ruffed Grouse drumming sites in western Washington and their relevance to management. *Ann. Zool. Fenn.* 15: 261-278.
- Salomonsen, F. (1939). Moults and sequences of plumages in the Rock Ptarmigan (*Lagopus mutus* (Montini)). *Vidensk. Medd. Dansk Naturh. Foren.* 103: 1-491.
- Salomonsen, F. (1950). *Greenlands Eagle*. Vol. 2. Copenhagen.
- Salomonsen, F. (1972). Zoogeographical and ecological problems in Arctic birds. Pp. 25-77 in: *Proc. XV Int. Orn. Congr.*, Hague, 1970.
- Salvador, D.J.I. (1994). Socio-economic incentives for the conservation of the rainforest habitat of the Philippine Eagle *Pithecophaga jefferyi*. In: Meyburg & Chancellor (1994a).
- Salvadori, T. (1914). Le specie del genere *Pipile*. *Riv. ital. Orn.* 3: 48-58.
- Salvan, J. (1968). Contribution à l'étude des oiseaux du Tchad. *Oiseaux et RFO* 38: 53-85.
- Salvan, J. (1971). Observations nouvelles à Madagascar. *Alauda* 39: 37-42.
- Salvin, O. (1860). History of Derbyan Mountain-Pheasant (*Oreophaps derbianus*). *Ibis* 2: 248-253.
- Salvo, G. (1989). Dati sulla biologia riproduttiva dell'Aquila del Bonelli, *Hieraaetus fasciatus*, in Sicilia. *Riv. it. Orn.* 59(1-2): 65-69.
- Samuel, D.E. (1974). Ruffed Grouse vocalizations at the drumming log. *Wilson Bull.* 86: 131-135.
- Sánchez, J.H. (1993). *The Ecology of Wintering Gyrfalcons (Falco rusticolus) in Central South Dakota*. MSc thesis, Boise State University, Idaho.
- Sanderson, G.C. & Shultz, H.C. eds. (1967). *Wild Turkey Management: Current Problems and Programs*. Missouri Chapter of the Wildlife Society and the University of Missouri Press, Columbia, Missouri, USA.
- Sankar, K., Mohan, D. & Pandey, S. (1993). Birds of Sarika Tiger Reserve, Rajasthan, India. *Fortkall* 8: 133-141.
- Sankaran, R. (1990). The Indian Mountain Quail: a preliminary survey. Pp. 135-137: *Status and Ecology of the Lesser and Bengal Floricans with Reports on Jerdon's Courser and Mountain Quail: Final Report*. Bombay Natural History Society.
- Santana C.E. & Temple, S.A. (1988). Breeding biology and diet of Red-tailed Hawks in Puerto Rico. *Biotropica* 20: 151-160.
- Santana, C.E., Knight, R.L. & Temple, S.A. (1986). Parental care at a Red-tailed Hawk nest tended by three adults. *Condor* 88: 109-110.
- Santiapillai, C. & Dissanayake, S. (1992). The status of the Blue Peafowl in the Rhuna National Park, Sri Lanka. *World Pheasant Assoc. News* 36: 29-31.
- Sapsford, C.W. (1986). Bioenergetics and hypothermia of Pygmy Falcons in the Kalahari Gemsbok National Park. *Gabur* 1: 20-21.
- Sargeant, D. (1993). *Gabon. A Birders Guide to Gabon*. West Africa. Published by author.
- Sarker, S.U. (1986). The adaptability of the pheasants of Bangladesh in disturbed habitats. In: Ridley (1986a).
- Sarker, S.U. & Iqbal, M. (1985). Observations on Pallas Fish Eagle *Haliaeetus leucorhynchus* in Bangladesh. *Bull. World Working Group on Birds of Prey* 2: 100-102.
- Sasaki, M., Nishida, C. & Hori, H. (1982). Banded karyotypes of the Green-backed Guan *Penelope jacquacu grami* (Cracidae), with notes on the karyotypic relationship of the Maleo Fowl (Megapodidae) and domestic fowl (Phasianidae) (Galliformes: Aves). *Chrom. Inf. Ser.* 32: 26-28.
- Satheesan, S.M. (1989a). A large roost of Pariah (Black) Kite in India. *Gabur* 4(1): 22.
- Satheesan, S.M. (1989b). Unusual feeding habits of Pariah (Black) Kite in India. *Gabur* 4(1): 22-23.
- Satheesan, S.M. (1989c). Communal resting behaviour of Pariah (Black) Kite in India. *Gabur* 4(2): 16.
- Satheesan, S.M. (1989d). On the differences in feeding between Scavenger and Indian White-backed Vultures. *Vulture News* 22: 49-50.
- Satheesan, S.M. (1989e). Behaviour of the Indian White-backed Vulture in the presence of man. *Vulture News* 22: 52-53.
- Satheesan, S.M. (1990a). An unrecorded feeding habit of Pariah Kite *Milvus migrans* *govinda* Sykes. *J. Bombay Nat. Hist. Soc.* 87(3): 450.
- Satheesan, S.M. (1990b). Some roost and nest sites of Pariah Kite in India. *Gabur* 5(1): 23.
- Sathyakumar, S. & Syam, V. (1992). Nesting site of Kalij Pheasant. *World Pheasant Assoc. News* 36: 20.
- Sathyakumar, S., Athreya, M. & Athreya, V.R. (1992). The Cheer Pheasant - a new recording. *World Pheasant Assoc. News* 37: 28.
- Sathyakumar, S., Prasad, S.N., Rawat, G.S. & Johnsingh, A.J.T. (1993). Ecology of Kalij and Monal Pheasants in Kedarnath Wildlife Sanctuary. Pp. 83-90 in: Jenkins (1993).
- Sathyanarayana, M.C. & Rathinasahapathy, B. (1992). Notes on the feeding ecology and activity of the Blue Peafowl. *J. World Pheasant Assoc.* 15(16): 97-101.
- Sathyanarayana, M.C. & Veeramani, A. (1993). Roosting trees used by Blue Peafowl in Tamil Nadu. Pp. 144-145 in: Jenkins (1993).
- Saunders, D.K. & Parrish, J.W. (1987). Assimilated energy of seeds consumed by Scaled Quail in Kansas. *J. Wildl. Manage.* 51: 787-790.
- Saunders, G.B. (1950). The game and shore birds of Guatemala. Pp. 3-98 in: Saunders *et al.* (1950)
- Saunders, G.B., Holloway, A. & Handley, C. (1950). *A Fish and Wildlife Survey of Guatemala*. US Fish and Wildlife Service, Special Scientific Report 5.
- Saunders, S. (1957). Notes on the White-breasted Sea-Eagle. *S. Austr. Orn.* 22: 47-48.
- Saurila, P. (1981). [Migration of the Sparrowhawk (*Accipiter nisus*) as revealed by Finnish ringing and migration data]. *Lintuties* 16: 10-18.
- Savage, C.D.W. ed. (1980). *Pheasants in Asia 1979*. Proceedings of the First International Symposium on Pheasants in Asia. Kathmandu, Nepal, 21-23 November, 1979. World Pheasant Association, Exning, UK.
- Savage, C.D.W. & Ridley, M.W. eds. (1987). *Pheasants in Asia 1982*. Proceedings of the Second International Symposium on Pheasants in Asia. Srinagar, Kashmir, September, 1982. World Pheasant Association, Reading, UK.
- Savory, C.J. (1977). The food of Red Grouse *Lagopus l. scoticus* chicks. *Ibis* 119: 1-9.
- Savory, C.J. (1978). Food consumption of Red Grouse in relation to age and productivity of heather. *J. Anim. Ecol.* 47: 269-282.
- Shodnikov, V.M. (1957). [The Siberian Rock Ptarmigan *Lagopus mutus kellingae* Grinn. in the northern limits of its range]. *Trudy Ark. Inst.* 205: 63-71.
- Seepetov, N.V. (1952). [On the ecology of the Steppe Eagle]. *Prirady* 7: 113-114. In Russian.
- Schmidt, C.P. (1991). Geographic variation in the growth of nestling Osprey. *J. Raptor Res.* 25(4): 159-160.
- Schmidt, C.P. & Bird, D.M. (1993). Sex-specific growth in Ospreys: the role of sexual size dimorphism. *Auk* 110: 900-910.
- Schäfer, E. (1934). Zur Lebensweise der Fasanen des chinesisch-tibetischen Grenzlandes. *J. Orn.* 82: 487-509.
- Schäfer, E. (1953a). Estudio bio-ecológico comparativo sobre algunos Cracidae del norte y centro de Venezuela. *Boi. Soc. Venez. Cienc. Nat.* 15: 30-63.
- Schäfer, E. (1953b). Analogía de adaptación entre plantas y animales de la selva nublada de "Rancho Grande". *Rev. Fac. Agronomía* 1: 1-9.
- Schäfer, E. (1954a). Bird with stone on its head. *F. Nutters* 18: 67-69.
- Schäfer, E. (1954b). [On the habits of *Penelope argentea*]. *Kosmos*, Stuttgart 50: 9-13, 118-124.
- Schäfer, E. & Phelps, W.H. (1954). Las aves del Parque Nacional Henri Pittier (Rancho Grande) y sus funciones ecológicas. *Boi. Soc. Venez. Cienc. Nat.* 16: 3-167.
- Kristiansen, W.J. (1956). *The Avifauna of Culm and Laguna de Jataico, Mexico*.
- Schätt, J. (1991a). La Gélinotte des bois. Biologie, éco-éthologie, mesures conservatoires. *Rev. For. Fr.* 43: 445-462.
- Schätt, J. (1991b). Étude du régime alimentaire de la Gélinotte des bois *Bonasa bonasia* dans l'Ain (première partie). *Alauda* 59: 89-100.
- Schätt, J. (1993). Étude du régime alimentaire de la Gélinotte des bois dans l'Ain (deuxième partie). *Alauda* 60: 19-34.
- Scheffler, W.J. & van Rossem, A.J. (1944). Nesting of the Laughing Falcon. *Auk* 61: 141-142.
- Schemnitz, S.D. (1956). Wild Turkey food habits in Florida. *J. Wildl. Manage.* 20(2): 132-137.
- Schemnitz, S.D. (1959). Past and present distribution of Scaled Quail (*Callipepla squamata*) in Oklahoma. *Southwestern Naturalist* 43: 148-152.
- Schemnitz, S.D. (1961). Ecology of the Scaled Quail in the Oklahoma Panhandle. *Wildl. Monogr.* 8: 1-47.
- Schemnitz, S.D. (1964). Comparative ecology of Bobwhite and Scaled Quail in the Oklahoma Panhandle. *Amer. Midl. Naturalist* 71: 429-433.
- Schenkel, R. (1956-58). Zur Deutung der Balzleistungen einiger Phasianiden und Tetraoniden. *Orn. Beob.* 53: 182-201; 55: 65-95.
- Scherer, P. & Cominetti, F.R. (1981). Contribution to the preservation of Jacutingas (*Pipile jacutinga* Spix, 1825) through reproduction in captivity. Pp. 261-266 in: Estudillo López (1981).
- Scheres, G. (1990). Les hoccos, survivront-ils? *Zoo Anvers* 55(3): 28-35.
- Scheres, G. (1993). First reintroduction of an endangered cracid. *Cracid News* 2(1): 1, 7-9.
- Scherini, G. (1977). *Studio dell'alimentazione della Pernice Bianca in provincia di Sondrio (Alpi Retiche e Ormbiche)*. Tesi di laurea, Università di Milano.
- Scherini, G. & Tosi, G. (1978). La pernice bianca, *Lagopus mutus helveticus* Thienemann, in provincia di Sondrio (biometria e relazioni trofiche con l'orizzonte alpino e nivale). *Boll. Zool.* 45(Suppl.): 47.
- Scherzinger, W. (1981). Stimminventar und Fortpflanzungsverhalten des Haselhühnchens *Bonasa bonasia*. *Orn. Beob.* 78: 57-86.
- Scheuerman, R.G. (1977). Hallazgos del Pajal *Crax mitu* (Aves-Cruidae) al norte del Rio Amazonas y notas sobre su distribución. *Lozania (Acta Zool. Colombian)* 22: 1-8.
- Schieck, J.O. & Hannon, S.J. (1989). Breeding site fidelity in Willow Ptarmigan: the influence of previous reproductive success and familiarity with partner and territory. *Oecologia* 81: 465-472.
- Schieck, J.O. & Hannon, S.J. (1992). Territory and male quality do not influence settlement of yearling female Willow Ptarmigan. *Behav. Ecol.* 3: 148-155.
- Schiffner, A. (1978). Neue Zög. schweizerischer und deutscher Schyazier. *Mitteil. Milvus migrans* nach Ringmarken. *Orn. Beob.* 64: 34-51.
- Schifter, H. (1989). Early longevity and breeding records of curassows (Cracidae). *Riv. ital. Orn.* 59(1-2): 70-74.
- Schiller, R.J. (1973). *Reproductive Ecology of Female Sharp-tailed Grouse (Pedicetes phasianellus) and its Relationship to Early Plant Succession in Northwestern Minnesota*. PhD thesis, University of Minnesota.
- Schiller, W.J.A. (1973). A comparison of prey selection in sympatric hawks. *Circus* spp. in Western Europe. *Geoffa* 63: 17-120.
- Schipper, W.J.A. (1977). Hunting in three European hawks (*Circus*) during the breeding season. *Alauda* 65: 53-72.
- Schipper, W.J.A. (1978). A comparison of breeding ecology in three European hawks. *Alauda* 66(3): 77-102.
- Schipper, W.J.A., Burman, L.A. & Bossenbroek, P. (1975). Comparative study of wintering Hen Harriers *Circus cyaneus* and Marsh Harriers *Circus aeruginosus*. *Ardea* 63: 1-29.
- Schlotkey, F., Schlotkey, E.C. & Talent, L.G. (1982). *Proceedings of the Second National Bobwhite Quail Symposium*. Oklahoma State University, Stillwater.
- Schladweiler, P. (1965). *Movements and Activities of Ruffed Grouse, Bonasa umbellus* (L.). During the Summer Period. PhD thesis, University of Minnesota, St. Paul.
- Schladweiler, P. (1968a). Feeding behavior of incubating Ruffed Grouse females. *J. Wildl. Manage.* 32: 426-428.
- Schladweiler, P. (1968b). *Blue Grouse Populations and Life History Study*. Fed. Aid Wildl. Res. Rep. W-91-R-9. Montana Fish and Game Department.
- Schlatter, R.P., Yáñez, J.L. & Jaksic, F.M. (1980). Food-niche relationships between Chilean eagles and Red-backed Buzzards in central Chile. *Auk* 97(4): 897-898.
- Schlatter, R.P., Toro, B., Yáñez, J.L. & Jaksic, F.M. (1980). Prey of the White-tailed Kite in central Chile and its relationship to the hunting habitat. *Auk* 97(1): 186-190.
- Schlatterer, E.F. (1960). *Productivity and Movements of a Population of Sage Grouse in Southeastern Idaho*. MSc thesis, University of Idaho.
- Schlee, M.A. (1987). Parade nuptiale et ceremonies de salut chez le Vautour pape *Sarcophaga papa* (L.). *C. R. Acad. Sci. Paris (Ser. III)* 91: 304: 207-212.
- Schleidt, E.W. (1983). Spatial and temporal pattern of calling sites in *Coturnix* quails. *Natl. Geogr. Res. Rep.* 15: 573-576.
- Schleidt, W.M. (1968). Precocial sexual behavior in Turkeys (*Melaneris gallinapa* L.). *Anim. Behav.* 16(4): 760-761.
- Schleidt, W.M., Yakalis, G., Donnelly, M. & McGarry, J. (1984). a proposal for a standard ethogram, exemplified by an ethogram of the Blue-breasted Quail (*Coturnix chinensis*). *A. Terepsychol.* 64: 193-220.
- Schmidt, D. (1982). *The Birds of the Serengeti National Park, Tanzania*. BOU Check-list 5 British Ornithologists' Union, London.
- Schmidt, F.J.W. (1936). Winter food of the Sharp-tailed Grouse and Pinnated Grouse in Wisconsin. *Wilson Bull.* 48: 186-203.
- Schmidt, W.K. (1969). *Behavior of White-tailed Ptarmigan in Colorado*. MSc thesis, Colorado State University, Fort Collins.
- Schmidt, R.K. (1988). Behavior of White-tailed Ptarmigan during the breeding season. Pp. 270-299 in: Bergerud & Gratson (1988).
- Schmitt, B.L. (1985). Micronesian megapode survey and research. Pp. 44-46 in: *Pittman-Robertson Federal Aid in Wildlife Restoration Program, Five Year Progress Report 1983-1987*. Division Fish & Wildlife, Commonwealth of the Northern Mariana Islands.
- Schmitt, M.B., Baur, S. & von Maltitz, F. (1980). Observations on the Steppe Buzzard in the Transvaal. *Ostrich* 51: 151-159.
- Schmitt, M.B., Baur, S. & von Maltitz, F. (1982). Mensural data, moult and abundance of the Little Banded Goshawk *Accipiter badius* in the Transvaal, South Africa. *Ostrich* 53: 74-78.
- Schmitt, M.B., Baur, S. & von Maltitz, F. (1987). Observations on the Jackal Buzzard *Buteo rufofuscus* in the Karoo. *Ostrich* 58: 97-102.
- Schmitz, A. (1991). *The Rufous-vented Chachalaca (Ortalis ruficauda), and the Effects of Man-induced Changes on its Habitat*. MSc thesis, University of Florida.
- Schmutz, J.E. (1977). Die Vögel der Mangrova (Flores). In: Schmutz, Roteng, Flores.
- Schmutz, J.A. & Braun, C.E. (1989). Reproductive performance of Rio Grande Wild Turkey. *Condor* 91(3): 675-680.
- Schmutz, J.K. (1977). *Relationships Between Three Species of the Genus, Buteo, and a Comparison with the Prairie-Land Ecology of Southwestern Alberta*. MSc thesis, University of Alberta, Calgary.
- Schmutz, J.K. (1984). *Ferruginous and Swainson's Hawk abundance and distribution in relation to land use in southwestern Alberta*. *J. Wildl. Manage.* 48: 1180-1178.
- Schmutz, J.K. (1987). Effect of agriculture on Ferruginous and Swainson's Hawks. *J. Range Manage.* 40: 438-440.
- Schmutz, J.K. & Fyfe, R.W. (1987). Migration and mortality of Alberta Ferruginous Hawks. *Condor* 89: 140-174.
- Schmutz, J.K. & Hungle, D.J. (1989). Population of Ferruginous and Swainson's Hawks increase in synchrony with ground squirrels. *Can. J. Zool.* 67: 2596-2601.
- Schmutz, J.K., Fyfe, R.W., Banasch, U. & Armbruster, H. (1991). Routes and timing of migration of falcons banded in Canada. *Wilson Bull.* 103: 44-58.
- Schmutz, S.M. & Robinson, T.M. (1993). *Comparative study of Ferruginous, Prairie and Cooper's Hawk populations in hybrids*. *J. Heredity* 78: 388-390.
- Schneegas, E.R. (1967). Sage Grouse and sagebrush control. *Trans. North Amer. Wildl. Nat. Resour. Conf.* 32: 270-274.
- Schneider, A. (1938). Bau und Erection der Hautpapillen von *Lophophanes bufo*. *J. Orn.* 86: 5-8.
- Schneider-Jacoby, M. (1994). Brutbestand des Seeadlers und des Schreiadlers in den Save-Aven (Kroatien) in Meyburg & Chancellor (1994b).
- Schnell, G.D. (1966a). *Population fluctuations, spatial distributions and food habits of Ruffed Grouse in Florida*. *Kansas Orn. Soc. Bull.* 18: 21-28.
- Schnell, G.D. (1967b). Environmental influence on the incidence of flight in the Rough-legged Hawk. *Auk* 84: 173-182.
- Schnell, G.D. (1968). Differential habitat utilization by wintering Rough-legged and Red-tailed Hawks. *Condor* 70: 373-377.
- Schnell, G.D. (1969). Communal roosts of wintering Rough-legged Hawks (*Buteo lagopus*). *Auk* 86: 682-690.

- Schnell, J.H. (1958). Nesting behavior and food habits of Goshawks in the Sierra Nevada of California. *Condor* 60: 37-40.
- Schnell, J.H. (1979). Bald Hawk (*Buteogallus anthracinus*). In: *Habitat Management Series for Unique or Endangered Species*. Bureau Land Management Report 18. US Department of Interior.
- Schodde, R. (1977). Contributions to Papuan ornithology. VI. Survey of the birds of southern Bougainville Island, Papua New Guinea. *CSIRO Div. Wildl. Res. Tech. Paper* 34.
- Schodde, R. (1978). The status of endangered Papuan birds. Appendix. Pp. 133-145, 185-206 in: Tyle, M.J. ed. (1978). *The Status of Endangered Australasian Wildlife*. Royal Zoological Society of South Australia, Adelaide.
- Schodde, R. (1993). Origins and evolutionary radiations in Australia's birds of prey [summary only]. In: Olsen
- Schodde, R. & Mason, I.J. (1980). *Nocturnal Birds of Australia*. Lansdowne, Melbourne.
- Schodde, R. & Tiedemann, S.C. eds. (1988). *Reader's Digest Complete Book of Australian Birds*. Reader's Digest Services, Sydney.
- Schodde, R., van Tets, G.F., Champion, C.F. & Hope, G.S. (1975). Observations on birds at glacial altitudes on the Carstensz Massif, western New Guinea. *Emu* 75: 65-72.
- Schönwetter, M. (1929). Vogeleier aus Kansa. *J. Orn.* 77: 35-40.
- Schönwetter, M. (1967). *Handbuch der Ornithologie*. Lieferung 8. Akademie-Verlag, Berlin.
- Schoonmaker, P. (1984). Observations on the nesting of the Black-chested Buzzard-Eagle (*Geranoetus melanoleucus*) in Peru. *Condor* 86(2): 221-222.
- Schorger, A.W. (1962). Audubon's original notes on the habits of the Wild Turkey written for Charles Lucien Bonaparte. *Auk* 79: 444-52.
- Schorger, A.W. (1963). The domestic turkey in Mexico and Central America in the sixteenth century. *Wisconsin Acad. Sci.* 52: 133-152.
- Schorger, A.W. (1966). *The Wild Turkey: its History and Domestication*. University of Oklahoma Press, Norman, Oklahoma, USA.
- Schouteden, H. (1918). Contribution à la faune ornithologique de la région des lacs de l'Afrique Centrale. *Rev. Zool. Afr.* 5: 209-297.
- Schouteden, H. (1937). A propos du Paon Congolais. *Bull. Séances Inst. Roy. Colonial Belge* 8: 578-583.
- Schouteden, H. (1963). La faune ornithologique du District de l'Iuiri. *Duc. Zool. Mus. Roy. Afr. Centr.* 5.
- Schouteden, H. (1968). La faune ornithologique du Kivu I. Non passerelle. *Duc. Zool. Mus. Roy. Afr. Centr.* 12.
- Schrader, N.W. (1985). Out of season breeding of the Spotted Harrier. *Austr. Birds* 19: 46-47.
- Schroeder, M.A. (1985a). *Aspects of Spruce Grouse Behaviour During the Brood Period, Fall and Spring Phases of Dispersal, and Migration*. MSc thesis, University of Alberta, Edmonton.
- Schroeder, M.A. (1985b). Behavioral differences of female Spruce Grouse undertaking short and long migrations. *Condor* 87: 281-286.
- Schroeder, M.A. (1986). The fall phase of dispersal in juvenile Spruce Grouse. *Can. J. Zool.* 64: 16-20.
- Schroeder, M.A. (1991). Movement and lek visitation by female Greater Prairie Chickens in relation to predictions of the female preference hypothesis of lek evolution. *Auk* 108: 896-903.
- Schroeder, M.A. & Boag, D.A. (1985). Behaviour of Spruce Grouse broods in the field. *Can. J. Zool.* 63: 2494-2500.
- Schroeder, M.A. & Boag, D.A. (1991). Spruce Grouse populations in successional lodgepole pine. *Ornis Scand.* 22: 186-191.
- Schroeder, M.A. & Braun, C.E. (1991). *Seasonal Movement and Habitat Use by Greater Prairie Chicken in Northwestern Colorado*. Special Report 68. Colorado Division Wildlife.
- Schroeder, M.A. & Braun, C.E. (1992). Greater Prairie-Chicken attendance at leks and stability of leks in Colorado. *Wilson Bull.* 104: 273-284.
- Schroeder, M.A. & Robb, L.A. (1993). *Greater Prairie Chicken*. No. 36 in: Poole & Gill (1993).
- Schuhart, O., Aquirre, A.C. & Sick, H. (1965). Contribuição para o conhecimento da alimentação das aves brasileiras. *Arq. Zool. São Paulo* 12: 95-249.
- Schuhert, W. (1977). Brutausfälle beim Wespenbussard (*Pernis ptilorhynchus*) in Baden-Württemberg. *Anz. Orn. Ges. Bayern* 16: 171-175.
- Schuchmann, K.L. ed. (1985). *Proceedings of the International Symposium on African Vertebrates: Systematics, Phylogeny and Evolutionary Ecology*. Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn.
- Schulenberg, T.S. & Parker, T.A. (1981). Status and distribution of some northwest Peruvian birds. *Condor* 83: 209-216.
- Schulz, J.W., Bukke, E.L. & Gulke, J.F. (1989). Characteristics of Ruffed Grouse drumming sites in the Turtle Mountains, North Dakota. *Prairie Nat.* 21: 17-26.
- Schulz, M. (1983). Nesting of the Square-tailed Kite in south eastern New South Wales. *Austr. Birds* 18: 6-8.
- Schulz, M. (1987). Temporal variation in the frequency of vocalisations of the New Guinea Harpy Eagle. *Emu* 87: 257-258.
- Schulz, G., Tinbergen, L. & Tinbergen, N. (1936). Ethologische Beobachtungen am Baumfalken (*Falco s. subbuteo* L.). *J. Orn.* 84: 387-433.
- Schwartz, C.W. (1945). The ecology of the Prairie Chicken in Missouri. *Univ. Missouri Studies* 20: 1-99.
- Schwartz, C.W. & Schwartz, E.R. (1951). An ecological reconnaissance of the pheasants of Hawaii. *Auk* 68: 281-314.
- Schwartz, P. (1972). *Microsaur gilvicolis*, a valid species sympatric with *M. ruficollis* in Amazonia. *Condor* 74: 399-415.
- Schwartz, P. & Lentino, M. (1984). Reproducción de la Perdiz de Montaña, *Oreophaps columbiana*. (PT) Serie Informes Técnicos DGSIA/IT/154.
- Schwenk, S. (1992). Grey Partridge *Pedix pedix* harvesting in Steiermark (Austria) between 1874 and 1914. Pp. 359-365 in: Birkan, Potts et al. (1992).
- Sclater, P.L. & Salvin, O. (1870). Synopsis of the Cracidae. *Proc. Zool. Soc. London*: 504-544.
- Sclater, W.L. (1918). *Buteo jakal archeri* subsp. n. described. *Bull. Brit. Orn. Club* 39: 17-18.
- Sclater, W.L. (1922). Notes on African birds (No. 4). *Bull. Brit. Orn. Club* 42: 72-76.
- Sclater, W.L. & Moreau, R.E. (1933). Taxonomic and field notes on some birds of north-eastern Tanganyika Territory. *Ibis Ser.* 13, no. 2: 1-33, 187-219, 399-440.
- Scott, D.A. (1976). The Caucasian Black Grouse (*Lyrurus tokosiewiczii*) in Iran. *J. World Pheasant Association* (1975/76): 66-68.
- Scott, D.A. & Brooke, M. de L. (1985). The endangered avifauna of southeastern Brazil: a report on the BOU/WWF expedition of 1980/81 and 1981/82. Pp. 115-139 in: Diamond & Lovejoy (1985).
- Scott, D.A. & Howell, D.L. (1976). Pheasant conservation in Iran. *J. World Pheasant Assoc.* 1: 82-87.
- Scott, J.A. (1983). Further notes on the breeding success of Long-crested Eagles *Lophotus occipitalis*. *Ostrich* 54: 183-184.
- Scott, J.M., Mountspring, S., Ramsey, F.L. & Kepler, C.B. (1986). *Forest Bird Communities of the Hawaiian Islands: their Dynamics, Ecology and Conservation*. Studies on Avian Biology 9.
- Scott, J.W. (1942). Mating behavior of the Sage Grouse. *Auk* 59: 472-498.
- Scott, M.D. (1982). Distribution and habitat use of White-tailed Ptarmigan in Montana. *Proc. Mont. Acad. Sci.* 41: 57-66.
- Scott, T.A. (1985). *Human Impacts on the Golden Eagle Population of San Diego County from 1928 to 1981*. PhD thesis, University of San Diego State, California.
- Scott, T.G. (1985). *Baldwhite-throated*. International Quail Foundation, Edgefield, South Carolina, USA.
- Searle, K. (1986). The captive maintenance and propagation of the peacock pheasants. In: Ridley (1986a).
- Searle, K. (1989). The captive maintenance and propagation of the genus *Polyplectron*. *J. World Pheasant Assoc.* 14: 16-32.
- Searle, R. (1992). Diet of the Secretarybird. *Winwatersand Bird Club News Sheet* 158: 12.
- Searle, R. (1993). Cuckoo Hawks at Mia's Farm. *Winwatersand Bird Club News Sheet* 158: 6-8.
- Seegar, J.K.D., Chandler, S.K., Fraser, J.D., Buchler, D.A. & Dean, D.J. (1994). Using a geographic information system to analyse Bald Eagle *Haliaeetus leucocephalus* habitat at Chesapeake Bay. In: Meyburg & Chancellor (1994a).
- Selkirk, E., Helbig, A.J. & Wink, M. (1993). Molecular systematics of falcons (Family Falconidae). *Naturwissenschaften* 80: 87-90.
- Selkirk, E., Helbig, A.J., Meyburg, B.A., Negro, J.J. & Wink, M. (1994). Genetic differentiation and molecular phylogeny of European *Aquila* eagles (Aves: Falconiformes) according to cytochrome b nucleotide sequences. MS.
- Seldruij, P. (1962). On the winter ecology of the Capercaillie, *Tetrao urogallus*, and the Black Grouse, *Lyrurus tetrix*, in Finland. *Fennish Game Res.* 22: 1-119.
- Seldruij, P. & Forskämper, J. (1955). Biological evidence of racial divergence in the Capercaillie, *Tetrao urogallus* L., in Finland. *Fennish Game Res.* 16: 1-31.
- Sell, D.J. (1979). *Spring and Summer Movements and Habitat Use by Lesser Prairie Chicken Females in Yukon County, N.M.*. MSc thesis, Texas Tech. University, Lubbock.
- Semenov, N.M., Agafonov, A.V., Rezinko, D.S. & Rozkov, A.A. (1962). [Breeding and numbers of the Steppe eagle in the steppes of the south of the Stalingrad area and the north of the Astrakhan area]. Pp. 159-163 in: *Gengreniya naseleniya buzemnykh zivotnykh i metody ego izucheniya*. Izd-vo AN SSSR, Moscow, In Russian.
- Semenov, N.M., Agafonov, A.V., Rezinko, D.S. & Rozkov, A.A. (1962). [The dependence of the distribution and numbers of the Steppe Eagle on the density of susliks in the Prisarpinsky steppes]. "Voprosy ekologii". Izd-vo "Vysshaya shkola". Kiev 6: 132-133. In Russian.
- Semenov-Tjan-Shanskij, O.I. (1960). *Ekologiya tetereninykh ptic* [Ecology of Tetraonids]. *Trudy Lapslandskogo gos. zapovednika* 5: 1-319. In Russian, translated to English in 1979 by AI Ahram Center for Scientific Translations, USA.
- Serez, M. (1992). Status, distribution and conservation of phasianid species in Turkey. Pp. 523-526 in: Birkan, Potts et al. (1992).
- Serfontein, J.H. (1961). Vultures eat Ostrich eggs. *Fauna & Flora, Transvaal* 12: 89.
- Serle, W. (1939). Field observations on northern Nigerian birds. *Ibis Ser.* 14, no. 3: 659-660.
- Serle, W. (1943). Further field observations on northern Nigerian birds. *Ibis* 85: 264-300.
- Serle, W. (1950). A contribution to the ornithology of the British Cameroons. *Ibis* 92: 343-376.
- Serle, W. (1954). A second contribution to the ornithology of the British Cameroons. *Ibis* 96: 47-90.
- Serle, W. (1962). The Cameroon Mountain Francolin. *Nigerian Field* 27: 34-36.
- Serle, W. (1965). A third contribution to the ornithology of the British Cameroons. Part I. *Ibis* 107: 60-94.
- Serle, W. (1981). The breeding season of birds in the lowland rainforest and in the montane forest of West Cameroon. *Ibis* 123: 62-74.
- Serle, W., Morel, G.J. & Hartwig, W. (1977). *A Field Guide to the Birds of West Africa*. Collins, London.
- Sermeno, A. (1986). *Alimentación y Reproducción del Pajul (Crax rubra) en El Salvador*. PhD thesis, Universidad de El Salvador, San Salvador.
- Sermos, W.O. & Speake, D.W. (1987). Production of second broods by Northern Bobwhites. *Wilson Bull.* 99: 285-286.
- Serna, M.A. (1980). *Catálogo de Aves. Museo de Historia Natural*. Museo de Historia Natural del Colegio de San José de Medellín, Medellín, Colombia.
- Servello, F.A. & Kirkpatrick, R.L. (1988). Nutrition and condition of Ruffed Grouse during the breeding season in southwestern Virginia. *Condor* 90: 836-842.
- Sessions, P.H.B. (1967). Notes on the birds of Lengetia Farm. *Mau Narok, J. East Afr. Nat. Hist. Soc.* 26: 18-48.
- Seth-Smith, D. (1932). The display of Rheinart's Pheasant. *Avicult. Mag.* 4: 122-132.
- Severinghaus, L.L. (1991). The status and conservation of Grey-faced Buzzard-eagles and Brown Shrikes migrating through Taiwan. Pp. 203-223 in: Salathé, T. (1991). *Conserving Migratory Birds*. ICBP Technical Publication 12.
- Severinghaus, L.L. & Severinghaus, S.R. (1990). The ecology and behaviour of Mikado and Swinhoe's Pheasants. Page 215 in: Hill et al. (1990).
- Severinghaus, S.R. (1977a). *A Study of the Swinhoe's and Mikado Pheasants in Taiwan with Recommendations for Their Conservation*. PhD thesis, Cornell University, Ithaca, New York, USA.
- Severinghaus, S.R. (1977b). Conservation of the Swinhoe's and Mikado Pheasants in Taiwan. *Pheasant Trust Ann. Rep.* 1976.
- Severinghaus, S.R. (1978). Recommendations for the conservation of the Swinhoe's and Mikado Pheasants in Taiwan. *J. World Pheasant Assoc.* 3: 79-89.
- Severinghaus, S.R. (1979). Observations on the ecology and behaviour of the Koklass Pheasant in Pakistan. *J. World Pheasant Assoc.* 4: 52-71.
- Severinghaus, S.R. (1980). Swinhoe's Pheasant in Taiwan. *Living Bird* 18: 189-209.
- Severinghaus, S.R. (1986). The adaptability of Mikado and Swinhoe's Pheasants to disturbed habitats in Taiwan. In: Ridley (1986a).
- Severinghaus, S.R. & Blackshaw, K.T. (1976). *A New Guide to the Birds of Taiwan*. Mei Ya Publications, Taipei, Taiwan.
- Severinghaus, S.R., Mirza, Z.B. & Asghar, M. (1979). Selection of a release site for the re-introduction of Cheer Pheasants in Pakistan. *J. World Pheasant Assoc.* 4: 100-115.
- Seymour, R.S. (1985). Physiology of megapode eggs and incubation mounds. Pp. 854-863 in: *Acta XVIII Int. Orn. Congr. Moscow*, 1982.
- Seymour, R.S. (1991). The Brush-turkey. *Scient. Amer.* (Dec.): 68-74.
- Seymour, R.S. & Ackerman, R.A. (1980). Adaptations to underground nesting in birds and reptiles. *Amer. Zool.* 20: 437-447.
- Seymour, R.S. & Bradford, D.F. (1992). Temperature regulation in the incubation mounds of the Australian Brush-turkey. *Condor* 94: 134-150.
- Seymour, R.S. & Rahn, H. (1978). Gas conductance in the eggshell of the mound-building brush turkey. Pp. 243-246 in: Piper, J. ed. (1978). *Respiratory Function in Birds, Adult and Embryonic*. Springer, Heidelberg.
- Seymour, R.S., Vleck, D. & Vleck, C.M. (1986). Gas exchange in the incubation mounds of megapode birds. *J. Comp. Physiol. B* 156: 773-782.
- Seymour, R.S., Vleck, D., Vleck, C.M. & Booth, D.T. (1987). Water relations of buried eggs of mound building birds. *J. Comp. Physiol. B* 157: 413-422.
- Shagdarsuren, O. (1964). [The birds of prey of central and southern Mongolia and their economic status]. Moscow, In Russian.
- Shah, I.H. (1993). Status, distribution and habitat of Koklass in Galis Tract and Kaghan Valley, Hazara Division, NWFP, Pakistan, in 1975-91. In: Jenkins (1993).
- Shank, C.C. & Poole, K.G. (1994). Status of the Gyrfalcon *Falco rusticolus* population in the Northwest Territories, Canada. In: Meyburg & Chancellor (1994a).
- Shank, C.C., Bromley, R.G. & Poole, K.G. (1993). Increase in breeding population of Tundra Peregrine Falcons in the central Canadian Arctic. *Wilson Bull.* 105: 188-190.
- Sharma, I. (1972). [Ecological study of breeding of the Peafowl, *Pavo cristatus*]. *Alandu* 40: 378-84. In French with English summary.
- Sharma, V. & Pandey, S. (1989). Pheasant surveys in the Shimla Hills of Himachal Pradesh, India. *J. World Pheasant Assoc.* 14: 64-79.
- Sharp, W.M. (1963). The effects of habitat manipulation and forest succession on Ruffed Grouse. *J. Wildl. Manage.* 27: 665-671.
- Sharpe, R.S. (1968). *The Evolutionary Relationships and Comparative Behavior of Prairie Chickens*. PhD thesis, University of Nebraska, Lincoln.
- Shaw, D. (1985). *The Breeding Biology of Urban-nesting Mississippi Kites (Ictinia mississippiensis) in West Central Texas*. MSc thesis, Angelo State University, San Angelo, Texas.
- Shaw, D. & Maxwell, T.C. (1988). First record of the Mississippi Kite for Bolivia. *J. Raptor Res.* 22: 90.
- Sheldon, B.C. & Duckworth, J.W. (1990). Rediscovery of the Madagascar Serpent Eagle *Eutriorchilus astur*. *Bull. Brit. Orn. Club* 110: 126-130.
- Shen Jun & Yu Xin-hua (1988). The feeding of *Serapius ellioti*. *Chinese J. Zool.* 23(6): 37-38.
- Shen Xiao-zhou & Wang Jia-jun (1963). On classification, distribution and ecology of Snowcocks in China. *Chinese J. Zool.* 5(2): 67-68.
- Sherry, J. (1984). The effect of predator avoidance by ghost crabs on the foraging success of Black Hawks. *Amer. Zool.* 24(3): 50A.
- Sherman, P.T. (1991). Harpy Eagle predation on a red howler monkey. *Folia Primatol.* 56(1): 53-56.
- Sherrod, S.K. (1978). Diets of North American Falconiformes. *J. Raptor Res.* 12(3/4): 49-121.
- Sherrod, S.K. (1983). *Behavior of Fledgling Peregrines*. The Peregrine Fund, Ithaca, New York.
- Sherrod, S.K., Estes, J. & White, C.M. (1975). Depredation of sea otter pups by Bald Eagles at Amchitka Island, Alaska. *J. Mammalogy* 56: 701-703.
- Sherrod, S.K., White, C.M. & Williamson, F.S.L. (1976). Biology of the Bald Eagle on Amchitka Island. *Living Bird* 15: 143-182.
- Shi Dong-chou (1985). Studies on the feeding habits of the Blood Pheasant in Baife Reserve, Nanping, Sichuan. *Zool. Res.* 6: 139-142.
- Shi Dong-chou (1986). Number of feathers of the Pheasant Grouse *Tetraophaps obscurus* and the Chinese Monal *Lophophorus luyisi*. *Zool. Res.* 7(1): 85-87.
- Shi Kun & Ding Han-lin (1988). [Reproductive ecology of the Eastern Red-footed Falcon, *Falco vespertinus amurensis*]. *Jilin Forest Sci. & Tech.* (2): 25-27. In Chinese.
- Shibayev, Yu.A. (1987). Interim report on a population survey of Steller's Sea Eagle in winter in USSR. Summary, page 48, in: *Third Japan-USSR Bird Protection Symposium, 21 November 1986*. Wild Bird Society of Japan, Tokyo.
- Shibnev, Yu.B. (1981). [The wintering of large raptors in the Primorye]. Pp. 100-107 in: Litvinenko (1988). In Russian.
- Shibnev, Yu.B. & Trukhin, A.M. (1988). [Winter census of *Haliaeetus pelagicus* and *H. albicilla* in Peter the Great's Bay (Primorye) in 1986: the first international census]. Pp. 117-119 in: Litvinenko (1988). In Russian.
- Shields, P.W. & Duncan, D.A. (1966). Fall and winter foods of California quail in dry years. *Calif. Fish & Game* 52: 275-282.
- Shirihai, H. & Christie, D.A. (1992). Raptor migration at Eilat. *British Birds* 85(4): 141-186.
- Shirihai, H. & Donnelly, P. (1990). Steppe Buzzards plumages. *Birding World* 3: 10-14.

- Shirihai, H., & Yekutieli, D. (1991). Raptor migration at Eilat - spring 1988. Pp. 2-12 in: Yekutieli, D. ed. (1991). *Raptors in Israel*. International Birdwatching Center, Eilat, Israel.
- Short, L.L. (1967). A review of the genera of grouse (Aves, Tetraoninae). *Amer. Mus. Novit.* **2289**: 1-39.
- Short, L.L. (1969). Taxonomic aspects of avian hybridization. *Auk* **86**: 84-105.
- Short, L.L. (1971). Aves nuevas o poco comunes de Corrientes, República Argentina. *Rev. Mus. Arg. Cienc. Nat. Bernardino Rivadavia (Zool.)* **9**(11): 283-309.
- Short, L.L. (1974). Nesting of southern Sonoran birds during the summer rainy season. *Condor* **76**(1): 21-32.
- Short, L.L. (1975). A zoogeographic analysis of the South American Chaco Avifauna. *Bull. Amer. Mus. Nat. Hist.* **154**: 163-352.
- Short, L.L., Horne, J.F.M., & Muringo-Gichuki, C. (1990). Annotated check-list of the birds of East Africa. *West. Found. Vert. Zool.* **4**.
- Showler, D.A. (1993). Long-billed Partridge *Rhinoceros longirostris*: a new species for Sabah. *Forktail* **8**: 156.
- Shrestha, T.K. (1992). Conservation status of the Swamp Partridge *Fringillanus gularis* in Nepal. Pp. 553-560 in: Birkan, Patis et al. (1992).
- Shufeldt, R.W. (1911). The extermination of the Wild Turkey in Virginia. *Auk* **30**: 144-146.
- Shufeldt, R.W. (1914). On the skeleton of the Ocellated Turkey (*Agriacharis ocellata*), with notes on the osteology of other Meleagridae. *Aquila* **21**: 1-52.
- Shuker, K.P.N. (1991). Gallinaceous mystery birds. *World Pheasant Assoc. News* **32**: 3-6.
- Shuker, K.P.N. (1993). *The Lost Ark. New and Rediscovered Animals of the 20th Century*. Harper Collins, London.
- Shummer, A. (1928). [Status of nests of the Steppe Eagle (*Aquila nipalensis orientalis* Cab.) on the area of the first Ukrainian Steppe Nature Reserve "Capli" (Askania-Nova). *Vysy Derz. step. zapov. "Capli"* (Askania-Nova) **7**: 47-69. In Ukrainian.
- Sibley, C.G. (1946). Breeding habits of megapodes on Simbo, Central Solomon Islands. *Condor* **48**: 92-93.
- Sibley, C.G. (1957). The evolutionary and taxonomic significance of sexual dimorphism and hybridization in birds. *Condor* **59**: 166-191.
- Sibley, C.G., & Ahlquist, J.E. (1972). A comparative study of the egg-white proteins of non-passerine birds. *Bull. Peabody Mus. Nat. Hist.* **39**: 1-276.
- Sibley, C.G., & Ahlquist, J.E. (1990). *Phylogeny and Classification of Birds: a Study in Molecular Evolution*. Yale University Press, New Haven.
- Sibley, C.G., & Monroe, B.L. (1990). *Distribution and Taxonomy of Birds of the World*. Yale University Press, New Haven & London.
- Sibley, C.G., Ahlquist, J.E., & Monroe, B.L. (1988). A classification of the living birds of the world, based on DNA-DNA hybridization studies. *Auk* **105**: 409-423.
- Sick, H. (1965). Jacus (*Penelope*) da região Amazônica (Aves, Cracidae). *Pap. Avuls. Zool. São Paulo* **17**: 9-16.
- Sick, H. (1968). Vogelwanderungen im kontinentalen Südamerika. *Vogelwarte* **24**: 217-243.
- Sick, H. (1969). Aves brasileiras ameaçadas de extinção e notas gerais de conservação de aves no Brasil. *An. Acad. Brasil. Cienc.* **41**(Suppl.): 205-229.
- Sick, H. (1970). Notes on Brazilian Cracidae. *Condor* **72**: 106-108.
- Sick, H. (1972). A ameaça da avifauna brasileira. Pp. 99-153 in: *Espécies da Fauna Brasileira Ameaçadas de Extinção*. Academia Brasileira de Ciências, Rio de Janeiro.
- Sick, H. (1978). Brasilien überfliegen von *Mitu mitu mitu* (1766). In: *Proc. XVII Int. Orn. Congr., Berlin, 1978*.
- Sick, H. (1979). Notes on some Brazilian birds. *Bull. Brit. Orn. Club* **99**(4): 115-120.
- Sick, H. (1980). Characteristics of the Razor-billed Curassow *Mitu mitu mitu*. *Condor* **82**: 227-228.
- Sick, H. (1983). Aves da Mata Atlântica em extinção. *Rev. Serv. Público* **111**: 155-157.
- Sick, H. (1985a). *Ornitologia brasileira. Uma introdução*. Edit. Universidade de Brasília, Brasília.
- Sick, H. (1985b). Curassow. Page 128 in: Campbell & Lack (1985).
- Sick, H. (1993). *Birds in Brazil. A Natural History*. Princeton University Press, Princeton, New Jersey.
- Sick, H., & Pabst, L.F. (1968). As aves do Rio de Janeiro (Guamabara). Lista sistemática anotada. *Arg. Mus. Nat. Rio de Janeiro* **53**: 99-160.
- Sick, H., & Teixeira, D.M. (1979). Notas sobre aves brasileiras raras ou ameaçadas de extinção. *Publ. Avuls. Mus. Nat.* **62**.
- Sick, H., do Rosário Bege, L.A., & de Azevedo, T.R. (1981). Aves do estado de Santa Catarina. *Sellowian Ser. Zool.* **1**.
- Sieg, C.H., & Becker, D.M. (1990). Nest-site habitat selected by Merlins in southeastern Montana. *Condor* **92**: 688-694.
- Siegfried, W.R. (1965a). Guineafowl using telephone poles as roosts. *Bokmakerte* **17**: 17.
- Siegfried, W.R. (1965b). Fiscal Shrike attacking young guineafowl. *Ostrich* **36**: 224.
- Siegfried, W.R. (1966). Growth, plumage development and moult in the Crowned Guineafowl *Numida meleagris cornuta* Gurney. *Dept. Nat. Conserv. Invest. Rep.* **8**: 1-52.
- Siegfried, W.R. (1968). Breeding season, clutch and brood sizes in Verreaux's Eagle. *Ostrich* **39**: 139-145.
- Siegfried, W.R. (1971). Chukar Partridge on Robben Island. *Ostrich* **42**: 158.
- Siegfried, W.R., & Frost, P.G.H. (1970). Notes on the Madagascar Kestrel *Falco newtoni*. *Ibis* **112**: 400-402.
- Siegfried, W.R., & Frost, P.G.H. (1973). Systematic notes on the small African buzzards. *Ibis* **61**: 123-127.
- Siegfried, W.R., & Skead, D.M. (1971). Status of the Lesser Kestrel in South Africa. *Ostrich* **42**: 1-4.
- Sierra, R. (1986). Evaluación de la productividad de *Geranotus melanoleucus* en los Andes de la provincia de Pichincha, Ecuador. In: *Resúmenes del X Congreso Latinoamericano de Zoología en Viña del Mar*.
- Siewert, F. (1932). Der Schreiadler. *J. Orn.* **80**: 1-40.
- Sigursjónsdóttir, H. (1981). The evolution of sexual size dimorphism in gamebirds, waterfowl and raptors. *Ornis Scandin.* **12**: 249-260.
- Silvonen, L. (1957). The problem of the short-term fluctuations in numbers of tetraonids in Europe. *Pap. Game Res.* **19**: 1-44.
- da Silva, G.L., & Nacinovic, J.B. (1991). Birds as indicators for the conservation of Atlantic Forests in Bahia, Brazil. Interim project report to WWF for the period July 1990-July 1991.
- da Silva, M.B., Dissanayake, S.R.B., & Santiapillai, C. (1993). Status of the Ceylon Junglefowl in Ruhuna National Park. *Sri Lanka J. World Pheasant Assoc.* **17**(18): 62-66.
- Silveira, C.E. (1988). Grey Falcon *Falco hypoleucos* at Colluluraine, Victoria. *Aust. Bird Watcher* **12**: 233-235.
- da Silveira, C.L., & Pais, J.A. (1986). Breeding and hand-rearing the Red-bellied Curassow *Crax blumenhachii* at Rio de Janeiro Zoo. *Int. Zoo Yb.* **24**: 245-244-247.
- Silvy, N.J. (1968). *Movements, Monthly Ranges, Reproductive Behavior, and Mortality of Radio-tagged Greater Prairie Chickens* (*Tympanuchus cupido pinnatus*). MSc thesis, Kansas State University, Manhattan.
- Simeon, D., & Wilhelm, J.L. (1988). Essai sur l'alimentation annuelle de l'Aigle de Bonelli *Hieratus fasciatus* en Provence. *Alauda* **56**(3): 226-237.
- Simeonov, S.D., & Petruv, T.I. (1980). Studies on the food of the Imperial Eagle (*Aquila heliaca*), the Common Buzzard (*Buteo buteo*) and the Rough-legged Buzzard (*Buteo lagopus*) in Bulgaria. *Bulg. Acad. Scienc. Ecol.* **7**: 20-30.
- Simeonov, S.D., Michev, T., & Nankinov, L. (1990). [The fauna of Bulgaria]. Vol. 20: Aves, part 1. In Bulgarian. Bulgarian Academy of Sciences, Sofia.
- Simmons, R. (1983). *Prey, Ecology and Mate Choice in the Northern Harrier Circus cyaneus*. MSc thesis, Southern University, Nova Scotia, Canada.
- Simmons, R. (1984). Pre-independence behaviour, morphometrics and trapping of fledgling Red-breasted Sparrow-hawks. *Ostrich* **55**: 158-162.
- Simmons, R. (1986a). Ecological Segregation of the Red-breasted Sparrowhawk *Accipiter erythrogastrus* and six coexisting accipitrine raptors in southern Africa. *Africa* **74**: 137-149.
- Simmons, R. (1986b). Food provisioning nestling growth and experimental manipulation of brood size in the African Red-breasted Sparrowhawk. *Behavioural Ecology* **17**: 31-40.
- Simmons, R. (1986c). In defence of Karoo Red-breasted Sparrowhawks. *Bokmakerte* **38**: 82-83.
- Simmons, R. (1988). Honey advertising, sexual selection, courtship display, and mate condition of polygynous male harriers. *Auk* **105**: 303-307.
- Simmons, R. (1989). How polygynous female Northern Harriers *Circus cyaneus* choose their mates and why they are deceived. Pp. 243-246 in: Meyburg & Chancellor (1989).
- Simmons, R. (1990). Copulation patterns of African Marsh Harriers: evaluating the paternity assurance hypothesis. *Anim. Behav.* **40**: 1151-1157.
- Simmons, R. (1991). The Comparisons and functions of sky-dancing displays of Circus harriers, among the marsh harrier complex. *Ostrich* **62**: 45-51.
- Simmons, R. (1992). The habits of a single migration mystery. *Galah* **6**: 3-5.
- Simmons, R. (1993). A sex and colour guide to Africa's commonest Eagle. *Binding in SA* **43**: 11-14.
- Simmons, R. (1994). Agonistic interactions and social control of sexual and parental care in harriers. *Ostrich* **65**: 81-89.
- Simmons, R. (1992a). Brood adoption and desert among African Marsh Harriers *Circus ranivorus*. *Ibis* **134**(1): 32-34.
- Simmons, R. (1992b). Population and siblicide studies of Wahlberg's Eagle in the western Sabi Sand Reserve, South Africa: a four-year summary. *Galah* **7**: 2-8.
- Simmons, R. (1993a). Chance, choice and habitat-related breeding success in a dense population of Wahlberg's Eagle *Aquila wahlbergi*. Pp. 133-139 in: Wilson (1993).
- Simmons, R. (1993b). Effects of supplementary feeding on density-reduced breeding in the African common accipitrine raptor or ecological constraint? *Ibis* **135**(4): 394-402.
- Simmons, R., Barnard, P.E., & Smith, P.C. (1987). Reproductive behaviour of *Circus cyaneus* in North America and Europe: a comparison. *Ornis Scandin.* **18**: 33-41.
- Simmons, R., Macwhirter, R.B., Barnard, P.E., & Hansen, G.L. (1986). The influence of microtines on polygyny, productivity and provisioning of the Northern Harrier: a 5-year study. *Can. J. Zool.* **64**: 2447-2456.
- Simms, K. (1989). *Home Range, Habitat Use, and Movement of Reintroduced Masked Bobwhite*. MSc thesis, University of Arizona, Tucson.
- Simonetti, J., Núñez, H., & Yáñez, J. (1982). *Falco sparverius*, rapaz generalista en Chile central (Aves, Falconidae). *Bol. Mus. Nat. Hist. Nat., Chile* **39**: 119-124.
- Sinclair, J.C. (1987). *Jan Sinclair's Field Guide to the Birds of Southern Africa*. Collins, London.
- Sinclair, J.C., & Dean, W.R.J. (1974). Grey Kestrel *Falco ardousaeus*. *Ostrich* **45**: 134.
- Sinclair, J.C., & Walters, B. (1976). Lanner Falcons breeding in Dubai City. *Bokmakerte* **28**: 51-52.
- Sinclair, J.C., & Whyte, I. (1991). *Field Guide to the Birds of the Kruger National Park*. Struik, Cape Town.
- Sinclair, J.C., Hockey, P.A.R., & Tarboton, W.R. (1993). *Social Birds of Southern Africa*. Struik, Cape Town.
- Singh, P. (1991). Sighting of Tibetan Blood Pheasants in Tawang District of Arunachal Pradesh. *World Pheasant Assoc. News* **32**: 11-12.
- Sisson, L. (1976). *The Sharp-tailed Grouse in Nebraska*. Nebraska Game and Parks Comm., Lincoln.
- Sitt H.H., Yáñez, J. (1991). The status and distribution of pheasants in Patagonia (Mammals). Pp. 77-79 in: Jenkins (1991).
- Skead, C.J. (1962). A study of the Crowned Guineafowl *Numida meleagris cornuta* Gurney. *Ostrich* **33**: 51-65.
- Skewes, P.A., Wilson, H.R., & Mather, E.B. (1988). Correlations among egg weight, chick weight, and yolk sac weight in Bobwhite Quail (*Colinus virginianus*). *Florida Sci.* **51**: 159-162.
- Skinner, K.L. (1925). Details of some nests and eggs of the Black Vulture, *Aegypius monachus* (L.) from the Province of Cáceres, Spain. *Dol. Rev.* **5**: 42-43.
- Skorup, J.P. (1981). A breeding record for Cassin's Hawk Eagle *Hieratus africanus*. *Scopus* **5**: 52-54.
- Skutch, A.F. (1945). Migration of Swainson's Hawks through Costa Rica. *Northwest Sci.* **19**: 80-89.
- Skutch, A.F. (1947a). A nesting of the Plumbeous Kite in Ecuador. *Condor* **49**(1): 25-31.
- Skutch, A.F. (1947b). Life history of the Marbled Wood-quail. *Condor* **49**: 217-232.
- Skutch, A.F. (1959). Red-throated Caracara - the scourge of the wasps. *Animal Kingdom* **62**: 8-13.
- Skutch, A.F. (1960). The Laughing reptile hunter of tropical America. *Animal Kingdom* **63**: 115-119.
- Skutch, A.F. (1963). Habits of the Chestnut-winged Chachalaca. *Wilson Bull.* **75**: 262-269.
- Skutch, A.F. (1965). Life history notes on two tropical American kites. *Condor* **67**(3): 235-246.
- Skutch, A.F. (1967). *Life Histories of Central American Highland Birds*.
- Skutch, A.F. (1971). *A Naturalist in Costa Rica*. University of Florida Press, Gainesville.
- Skutch, A.F. (1983a). *Birds of Tropical America*. University of Texas Press, Austin, Texas.
- Skutch, A.F. (1983b). *Herpetohierus cochinnus* (Guaco, Laughing Falcon). Pp. 582-583 in: Janzen, D.H. ed. (1983). *Costa Rican Natural History*. University of Chicago Press, Chicago.
- Sládek, J. (1955). [Der Schreiadler in der Slowakei]. *Ornithologica* **10**: 176-181. In Slovak with German summary.
- Sládek, J. (1957). [Beitrag zur Kenntnis der Nidobiologie und der postembryonalen Entwicklung des Schreiadlers (*Aquila pomarina*)]. *Acta rector nat. Mus. Slov.* **3**: 1-8. In Slovak with German summary.
- Sládek, J. (1959a). [Die Moria "fulviventris" des Schreiadlers (*Aquila pomarina*)]. *Sylvia* **16**: 279-281. In Slovak with German summary.
- Sládek, J. (1959b). [Zur Ernährung des Schreiadlers in der Slowakei]. *Ornithologica* **10**: 176-181. In Slovak with German summary.
- Sládek, J. (1959c). [Zum Problem des vorzeitigen Absterbens des zweiten Jungen beim Schreiadler (*Aquila pomarina* Brehm)]. *Biologia Bratislava* **14**: 448-454. In Slovak with German summary.
- Sládek, J. (1959d). [Die Aneulierung des Kaiseradlers (*Aquila heliaca*) in Mitteleuropa und sein Brutvorkommen in der Slowakei]. *Sylvia* **16**: 79-95. In Slovak with German summary.
- Sládek, J. (1963). [Prspěvek k poznání ekologie, histologie, fyziologie, a chovu *Aquila pomarina*]. *J. Zool. Listy* **12**: 58-100.
- Sládek, J. (1993). [Beitrag zur Ernährung des Schreiadlers (*Aquila pomarina*) in der Slowakei]. *Ornithologica* **6**: 29-47. In Slovak with German summary.
- Slagsvold, T. (1975). Production of young by the Willow Grouse (*Lagopus lagopus* (L.)) in Norway in relation to temperature. *Norwegian J. Zool.* **23**: 269-275.
- Slagsvold, T., & Grasman, T. (1979). Autumn population size of the Capercaillie in relation to weather. *Ornis Scandin.* **10**: 37-41.
- Slotow, R., & Perrin, M.R. (1992). The importance of large prey for Blackshouldered Kite reproduction. *Ostrich* **63**: 180-182.
- Slotow, R., Mendelsohn, J.M., & Perrin, M.R. (1987). The diet of adult and nestling Blackshouldered Kites, and breeding success. *Ostrich* **59**: 150-154.
- Smith, P. (1964). *The Birds of Costa Rica. Description and Ecology*. Bulletin American Museum Natural History **128**.
- Sludskij, A.A. (1962). [Relationships between raptors and their prey species]. *Trudy Inst. Zool. Akad. Nauk Kazakhsk.* **55**: 17-143. In Russian.
- Small, R.J., & Rusch, D.H. (1989). The daily dispersal of Rufed Grouse. *Auk* **106**: 72-79.
- Small, R.J., Holzwarth, J.C., & Rusch, D.H. (1991). Predation and hunting mortality of Rufed Grouse in central Wisconsin. *J. Wildl. Manage.* **55**: 512-521.
- Smallwood, J.A. (1981). *Prey, Ecology and Mate Choice in the Northern Harrier Circus cyaneus*. MSc thesis, Southern University, Nova Scotia, Canada.
- Smallwood, J.A. (1980). American Kestrel and Merlin. Pp. 29-37 in: *Proc. SI. Raptor Manage. Symp. and Workshop*. National Wildlife Federation Scientific Technical Series 14. National Wildlife Federation, Washington, D.C.
- Smart, A.C. (1991). Density and distribution of the African Fish Eagle *Haliaeetus vocifer* on Lakes Naivasha and Oludien, Kenya. *Scopus* **14**: 76-83.
- Smeenk, C. (1974). Comparative ecological studies of some East African birds of prey. *Ardea* **62**: 1-97.
- Smeenk, C., & Smeenk-Enserink, N. (1976). Observations on the Pale Chanting Goshawk *Micropodops poliopterus* with comparative notes on the Gabar Goshawk *Micropodops gabar*. *Ardea* **63**: 93-115.
- Smeenk, C., & Smeenk-Enserink, N. (1977). Observations on the Shikra *Accipiter badius* in Nigeria. *Ardea* **65**: 148-164.
- Smeenk, C., & Smeenk-Enserink, N. (1983). Observations on the Harrier Hawk *Polyboroides vespertinus* in Nigeria with comparative notes in the Neotropical Zone Hawk *Comparative Ornithology*. *Ardea* **71**: 105-107.
- de Smet, K.D., & Conrad, M.P. (1991). Status, habitat requirements, and adaptations of Ferruginous Hawks in Manitoba. Pp. 219-221 in: Holroyd, G.L., Burns, G., & Smith, H.C. eds. (1991). *Proc. 2nd Endangered Species and Prairie Conservation Workshop*. Prov. Mus. Alberta Nat. Hist. Occ. Pap. **15**.
- Smith, D.G., & Murphy, J.R. (1973). Breeding ecology of raptors in the eastern Great Basin of Utah. *Brehm Young Univ. Sci. Bull. (Nat. Ser.)* **18**: 1-76.
- Smith, D.G., & Murphy, J.R. (1978). Biology of the Ferruginous Hawk in central Utah. *Sociobiology* **3**: 79-98.
- Smith, D.G., Murphy, J.R., & Woffinden, N.D. (1981). Relationships between jackrabbit abundance and Ferruginous Hawk reproduction. *Condor* **83**: 52-56.
- Smith, D.G., Wilson, C.R., & Frost, H.H. (1972). The biology of the American Kestrel in central Utah. *Southwestern Naturalist* **17**: 73-83.
- Smith, D.S., & Cain, J.R. (1984). Criteria for age classification of juvenile Scaled Quail. *J. Wildl. Manage.* **48**: 187-190.
- Smith, G. (1992). Gurney's Eagle *Aquila gurneyi* at Lac's city centre. *Murik* **5**: 92.
- Smith, G.C. (1985). An analysis of prey remnants from Osprey *Pandion haliaetus* and White-bellied Sea Eagle *Phalacrocorax leucogaster* feeding on fish. *Ardea* **63**: 105-108.
- Smith, J.D. (1988). *The Biology of the Red Goshawk*. *Ardea* **66**: 105-108.
- Smith, J.P., Hoffman, S.W., & Gessaman, J.A. (1990). Regional size differences among fall-migrant accipiters in North America. *J. Field Orn.* **61**: 192-200.
- Smith, J.W. (1986). *Characteristics of Mississippi Kite Nesting Habitat at Donaldson Point State Forest*. Missouri State of Records, Missouri Department of Conservation, Columbia, Missouri.
- Smith, K.D. (1965). On the birds of Morocco. *Ibis* **107**: 493-520.
- Smith, K.D. (1991). Aerial display of the Red Goshawk *Accipiter erythrogastrus*. *Aust. Bird Watcher* **14**: 147-148.
- Smith, N.G. (1969). Provoked release of mobbing - a hunting technique of *Marastur falcon*. *Ibis* **111**: 241-243.
- Smith, N.G. (1974). *Ecology of Kestrels in the British Isles*. *Ibis* **116**: 212-214.
- Smith, N.G. (1980). Hawk and vulture migrations in the Neotropics. Pp. 51-65 in: Keast & Morton eds. (1980). *Smith, N.G. (1985) Dynamics of the transatlantic migration of raptors between Central and South America*. Pp. 271-290 in: Newton & Chancellor (1985).

- Smith, N.G., Goldstein, D.L. & Bartholomew, G.A. (1986). Is long-distance migration possible for soaring hawks using only stored fat? *Auk* 106: 607-611.
- Smith, T.B. (1982). Nests and young of two rare raptors from Mexico. *Biotropica* 14(1): 79-80.
- Smith, T.B. & Temple, S.A. (1982a). Feeding habits and bill polymorphism in Hook-billed Kites. *Auk* 99(2): 197-207.
- Smith, T.B. & Temple, S.A. (1982b). Grenada Hook-billed Kites: recent status and life history notes. *Condor* 84(1): 131.
- Smith, F.B. (1966). *The Birds of Tikal*. American Museum of Natural History, Natural History Press, Garden City, New York.
- Smith, F.B. & Paynter, R.A. (1963). Birds of Tikal, Guatemala. *Bull. Mus. Comp. Zool.* 128: 259.
- Smyth, K.E. & Boag, D.A. (1984). Production in the Spruce Grouse and its relationship to environmental factors and population parameters. *Can. J. Zool.* 62: 2250-2257.
- Smythies, B.E. (1957). An annotated checklist of the birds of Borneo. *Sarawak Mus. J.* 7: 523-818.
- Smythies, B.E. (1981). *The Birds of Borneo*. Sabah Society & Malaysian Nature Society, Sabah & Kuala Lumpur.
- Smythies, B.E. (1986). *The Birds of Burma*. Nimrod Press, Liss, Hants, UK.
- Snelling, J.C. (1970). Some information obtained from marking large raptors in the Kruger National Park, Republic of South Africa. *Ostrich* 8(Suppl.): 415-427.
- Snelling, J.C., Kemp, A.C. & Lincer, J.L. (1984). Organochlorine residues in southern African raptor eggs. Pp. 161-168 in: Mendelsohn, J.M. & Sapsford, C.W. eds. (1984). *Proc. 2nd Sympos. Afr. Pred. Birds*. Natal Bird Club, Durban.
- Snow, C. (1973a). *Bald Eagle*. Habitat Management Series for Unique or Endangered Species. US Bureau of Land Management Tech. Note 171, report 5.
- Snow, C. (1973b). *Golden Eagle*. Habitat Management Series for Unique or Endangered Species. US Bureau of Land Management Tech. Note 171, report 7.
- Snow, D.W. ed. (1978). *An Atlas of Speciation in African Non-passerine Birds*. British Museum (Natural History), London.
- Snow, D.W. (1985). Affinities and recent history of the avifauna of Trinidad and Tobago. Pp. 238-246 in: Buckley, P. ed. (1985). *The Birds of Guyana*. Peabody Museum, Salem, Massachusetts.
- Snyder, L.L. (1935). *A Study of Sharp-tailed Grouse*. University of Toronto Studies, Biological Series No. 40.
- Snyder, N.F.R. (1975). Breeding biology of Swallow-tailed Kites in Florida. *Living Bird* 13: 73-97.
- Snyder, N.F.R. (1983). California Condor reproduction, past and present. *Bird Conserv.* 1: 67-86.
- Snyder, N.F.R. (1987). *The Parrots of Luquillo: Natural History and Conservation of the Puerto Rican Parrot*. Western Foundation of Vertebrate Zoology, Los Angeles.
- Snyder, N.F.R. & Hamber, J.A. (1985). Replacement-clutching and annual nesting of California Condors. *Condor* 87: 374-378.
- Snyder, N.F.R. & Johnson, E.V. (1985). Photographic censusing of the 1982-1983 California Condor population. *Condor* 87: 1-13.
- Snyder, N.F.R. & Kale, H.W. (1983). Mollusc predation by Snail Kites in Colombia. *Auk* 100(1): 93-97.
- Snyder, N.F.R. & Snyder, H.A. (1969). A comparative study of mollusc predation by Limpkins, Everglades Kites, and Boat-tailed Grackles. *Living Bird* 8: 177-223.
- Snyder, N.F.R. & Snyder, H.A. (1970). Feeding territories in the Everglade Kite. *Condor* 72(4): 492-493.
- Snyder, N.F.R. & Snyder, H.A. (1979). Biology of North American accipiters in Arizona and New Mexico. *Natl. Geographic Soc. Res. Rept.* (1979 projects): 487-491.
- Snyder, N.F.R. & Snyder, H.A. (1989). Biology and conservation of the California Condor. *Current Ornithology* 6: 175-267.
- Snyder, N.F.R. & Snyder, H.A. (1991). *Birds of Prey: Natural History and Conservation of North American Raptors*. Voyageur Press, Stillwater, Minnesota, USA.
- Snyder, N.F.R. & Wiley, J.W. (1976). *Sexual Size Dimorphism in Hawks and Owls of North America*. Ornithological Monograph 30. American Ornithologists' Union.
- Snyder, N.F.R., Beissinger, S.R. & Chandler, R.E. (1989). Reproduction and demography of the Florida Everglade Snail Kite. *Condor* 91(2): 300-316.
- Snyder, N.F.R., Johnson, E.V. & Clendenen, D.A. (1987). Primary moult of California Condors. *Condor* 89: 468-485.
- Snyder, N.F.R., Ramey, R.R. & Sibley, E.C. (1986). Nest site biology of the California Condor. *Condor* 88: 228-241.
- Snyder, N.F.R., Snyder, H.A., Lincer, J.L. & Reynolds, R.T. (1973). Organochlorines, heavy metals, and biology of North American accipiters. *BioScience* 23: 300-305.
- Sodhi, N.S. (1991a). *Foraging Ecology of Urban-breeding Merlins (Falco columbarius)*. PhD thesis, University of Saskatchewan, Saskatoon, Canada.
- Sodhi, N.S. (1991b). Pair copulations, extra-pair copulations, and intraspecific nest intrusions in Merlins. *Condor* 93: 434-437.
- Sodhi, N.S., Oliphant, L.W., James, P.C. & Warkentin, I.G. (1993). Merlin (*Falco columbarius*). No. 44 in: Poole & Gill (1993).
- Sodhi, N.S., Warkentin, I.G. & Oliphant, L.W. (1991). Hunting techniques and success rates of urban Merlins (*Falco columbarius*). *J. Raptor Res.* 25: 127-131.
- Sokiro, T., Nobuo, S. & Chiba, S. (1969). On territory of Japanese Ptarmigan (*Lagopus lagopus japonicus* Clark) in the Murodo area, Tayama, Japan Alps, in 1967 and 1968. *Misc. Rep. of the Natural Park for Nature Study* 1: 14-18.
- del Solar, G. (1988). Manejo de la pava aliblanca (*Penelope albipennis*) en cautiverio. Unpublished report presented at the II International Cracid Symposium, Caracas, Venezuela, February/March 1988.
- Solomatin, A.O. (1974). [Feeding of Imperial Eagles (*Aquila heliaca*) in Naurzum Preserve]. *Ekologiya* 3: 78-80. In Russian.
- Solomatin, A.O. (1974). [The Imperial Eagle and the Saker Falcon on the Turgaysk Plateau and the natural environment]. *Izvl. Moskovskogo Obshch. Ispytatel'skogo Priroda N.S. Otd. biolog.* 79(3): 40-51. In Russian.
- Solomon, K.E. & Robel, R.J. (1980). Effects of carbaryl and carbofuran on Bobwhite energetics. *J. Wildl. Manage.* 44: 682-686.
- van Someren, V.G.L. (1916). A list of birds collected in Uganda and British East Africa, with notes on their nesting and other habits. Part I. *Ibis Ser.* 10, no. 4: 193-252.
- van Someren, V.G.L. (1918). Another rare forest francolin *Francolinus nani* Dubois (Type locality - Ituri Forest, Congo). *J. East Afr. & Uganda Nat. Hist. Soc.* 6(18): 199-200.
- van Someren, V.G.L. (1922). Notes on the birds of East Africa. *Novit. Zool.* 29: 1-246.
- van Someren, V.G.L. (1925-1935). The birds of Kenya and Uganda, Parts I and II. *J. East Afr. & Uganda Nat. Hist. Soc.* 21: 1-8.
- van Someren, V.G.L. (1926). The birds of Kenya and Uganda. Part III. *J. East Afr. & Uganda Nat. Hist. Soc.* 7(25): 29-60.
- van Someren, V.G.L. (1956). Days with birds. *Fieldiana Zool.* 38.
- Sonin, V.D. & Lipin, S.I. (1980). [Seasonal aspects of ecology of the Imperial Eagle in Pribika'lye]. Pp. 122-124 in: [Seasonal rhythms of rare and endangered species of plants and animals]. Moscow, In Russian.
- Sonter, C. (1987). Distinguishing and sunning behaviour in Black and Whistling Kites *Milvus migrans* and *Haliastur sphenurus*. *Austr. Bird Watcher* 12: 96-97.
- Sonter, C. & Debus, S.J.S. (1985). The Brown Falcon *Falco bergii* as a predator of snakes. *Austr. Bird Watcher* 11: 92-93.
- Sopuck, I.G. (1979). *Movements and Breeding Biology of Blue Grouse in Relation to Recruitment, Reproductive Success, and Migration*. MSc thesis, University of Alberta, Edmonton.
- Sopuck, I.G. & Zwickel, F.C. (1983). Nesting in adult and yearling Blue Grouse. *Can. J. Zool.* 61: 289-291.
- Soroila, S.H. (1986). *Investigation of Mearns Quail distribution (in Texas)*. Final report, project W-108-R-9. Texas Parks and Wildlife Department.
- Soto, P. (1986). Le statut du Vautour fauve *Gyps fulvus* au Maroc. *Bull. World Working Group on Birds of Prey* 3: 173-180.
- Soto-Largo, E. & Martí, R. (1994). El Águila Imperial en la Comunidad de Madrid. *La Gacilla* 89: 42-46.
- Spagno, S. (1978). Note sulla distribuzione delle specie di uccelli rapaci in Italia. *Atti del Museo Civico di Storia Nat. di Genova* 82: 154-164.
- Spagno, S., Travasso, G., Truffi, G. & Zaccchetti, D. (1989). La pernice rossa *Alectoris rufa* (L.) in Italia. *Boll. Mus. Civ. Nat. Univ. Genova* 53: 5-33.
- Sparling, D.W. (1979). *Reproductive Isolating Mechanisms and Communication in Greater Prairie Chickens (Tympanuchus cupido) and Sharp-tailed Grouse (Pedioecetes phasianellus)*. PhD thesis, University of North Dakota, Grand Forks.
- Sparling, D.W. (1983). Quantitative analysis of prairie grouse vocalizations. *Condor* 85: 30-42.
- Sparks, R.D. (1979). Prey catching behavior in the Sparrowhawk. *J. Wildl. Manage.* 43: 397-408.
- Spawls, S. (1986). The Secretary Birds and the snake. *Bubblers* 11: 28-30.
- Speake, D.W., Metzler, R. & McGlinchey, J. (1985). Mortality of Wild Turkey poults in northern Alabama. *J. Wildl. Manage.* 49(2): 472-474.
- Spears, G.S., Guthery, F.S., Rice, S.M., DeMaso, S.J. & Zaiglin, B. (1993). Optimum seral stage for Northern Bobwhites as influenced by site productivity. *J. Wildl. Manage.* 57: 805-811.
- Sperdan-Lewis, J. (1939). Courting display of Napoleon's Peacock Pheasant *Polypheasant napoleonis*. *Avicult. Mag.* (54): 233-235.
- Speer, G. (1988). Taitafulkenbeobachtung (*Falco fasciatus*) am Mt Elgon in Uganda. *Beitr. Vogelk.* 34: 56-60.
- Speiser, R. & Bosakowski, T. (1984). History, status, and future management of Goshawk nesting in New Jersey. *Records of New Jersey Birds* X(2): 29-33.
- Speiser, R. & Bosakowski, T. (1989). Nest site selection by Northern Goshawks in northern New Jersey and southeastern New York. *Condor* 89: 387-394.
- Speiser, R. & Bosakowski, T. (1991). Nesting phenology, site fidelity, and defence behaviour of Northern Goshawks in New York and New Jersey. *J. Raptor Res.* 25: 132-135.
- Spidso, T.K. (1980). Food selection by Willow Grouse *Lagopus lagopus* chicks in northern Norway. *Ornis Scand.* 11: 99-105.
- Spidso, T.K. (1992). Egg size in relation to re-nesting in Capercaillie *Tetrao urogallus*. *Fauna Norvegica (Ser. C. Cinclus)* 15: 63-65.
- Spidso, T.K. & Stuen, O.H. (1988). Food selection by Capercaillie chicks in southern Norway. *Can. J. Zool.* 66: 279-283.
- Spidso, T.K. & Stuen, O.H. (1991). Age determination of young Capercaillie *Tetrao urogallus* chicks. *Fauna Norvegica (Ser. C. Cinclus)* 14: 29-32.
- Spidso, T.K., Wege, P. & Storaas, T. (1985). Renesting in Capercaillie in southern Norway. Pp. 278-288 in: Lovel & Hudson (1985).
- Spina, F., Scappi, A., Berthemy, B. & Pinna, G. (1987). The diet of Eleonora's Falcon (*Falco eleonorae*) in a colony of the western coast of Sardinia, with some remarks on the migration of small passerines through the Mediterranean. Pp. 235-252 in: Baccetti & Spagnesi (1987).
- Spittler, H. (1977). On the acclimatization of the Wild Turkey (*Meleagris gallopavo*) in North Rhine-Westphalia. *Trans. Congr. Internat. Union Game Biol.* 13: 313-318.
- Spitzer, P.R. (1989). Osprey. Pp. 22-31 in: *NE Raptor Management Symposium and Workshop*. National Wildlife Federation, Washington, D.C.
- Spitzer, P.R., Riebrogh, R.W., Walker, W., Hernández, R., Poole, A.F. & Puleston, D. (1978). Productivity of Ospreys in Connecticut-Long Island increases as DDT residues decline. *Science* 202: 333-335.
- Sprunt, A. (1945). The phantom of the marshes. *Audubon* 47: 15-22.
- Sprunt, A., Robertson, W.B., Postupalsky, S., Hansel, R.J., Knoder, C.E. & Ligas (1973). Comparative productivity of six Bald Eagle populations. *Trans. North Amer. Wildl. Nat. Resour. Conf.* 38: 96-106.
- Spurrier, M.F., Boyce, M. & Manly, F.J. (1990). Effects of parasites on mate choice by captive Sage Grouse. Pp. 389-398 in: Loe, J.E., Ripper, C.V. & Zuk, M. eds. (1990). *Ecology, Behaviour and Evolution of Bird-Parasite Interactions*. Oxford University Press, Oxford.
- Squires, J.R., Anderson, S.H. & Oakleaf, R. (1993). Home range size and habitat-use patterns of nesting Prairie Falcons near oil developments in northeastern Wyoming. *J. Field Orn.* 64: 1-10.
- Stafford, S.K. & Dimmick, R.W. (1979). Autumn and winter foods of Ruffed Grouse in the southern Appalachians. *J. Wildl. Manage.* 43: 121-127.
- Stager, K.E. (1964). The role of olfaction in food location by the Turkey Vulture *Cathartes aura*. *Los Angeles Co. Mus. Contrib. Sci.* 81.
- Stagg, A. (1985). *Birds of SW Saudi Arabia. An Annotated Checklist*. A. Stagg, Riyadh, Saudi Arabia.
- Stahlecker, D.W. & Beach, W. (1979). Successful nesting of Cooper's Hawks in an urban environment. *Int. Bird Banding* 51: 56-57.
- Stalmaster, M.V. (1987). *The Bald Eagle*. Universe Books, New York.
- Stalmaster, M.V. (1988). *Ferruginous Hawk Nesting Mitigation Study: Final Report*. Rio Blanco & Moffat Counties, Colorado, Uintah County, Utah. Western Fuels-Utah, ERO Res. Corp., Denver, Colorado.
- Standing, K.M. (1960). *Factors in Relation to Population Fluctuations in Blue Grouse*. PhD thesis, Washington State University, Pullman.
- Stapel, C. (1976). Some observations on behaviour and display of peacock pheasants. *J. World Pheasant Assoc.* 1: 109-112.
- Stark, H. & Liechti, F. (1993). Do Levant Sparrowhawks *Accipiter brevipes* also migrate at night? *Ibis* 135(3): 233-236.
- Stark, J.M. (1988). Note on the skull morphology of *Macrocephalon maleo*. *Megapode Newsl.* 2: 5-7.
- Staub, F. (1971). Actual situation of the Mauritian endemic birds. *ICBP Bull.* 11: 226-227.
- Staub, F. (1976). *Birds of the Muscarenes and St. Brandon*. Organisation Normale des Entreprises Liée, Port Louis.
- Stauffer, D.F. (1983). *Seasonal Habitat Relationships of Ruffed and Blue Grouse in southeastern Idaho*. PhD thesis, University of Idaho, Moscow, Idaho.
- Stauffer, D.F. (1985). See Stauffer & Peterson (1985).
- Stauffer, D.F. (1986). Seasonal microhabitat relationships of Blue Grouse in southern Idaho. *Great Basin Nat.* 46: 112-120.
- Stauffer, D.F. & Peterson, S.R. (1985). Ruffed and Blue Grouse habitat use in southeastern Idaho. *J. Wildl. Manage.* 49: 459-466.
- Stauffer, D.F., Cline, G.A. & Tonkovich, M.J. (1990). Evaluating potential effects of CRP on Bobwhite Quail in Piedmont Virginia. *Trans. North Amer. Wildl. Nat. Resour. Conf.* 55: 57-67.
- Steadman, D.W. (1980). A review of the osteology and paleontology of turkeys (Aves: Meleagridinae). *Contribution of the Science and Natural History Museum of Los Angeles County*. California. 330: 131-207.
- Steadman, D.W. (1989). New species and records of birds (Aves: Megapodiidae, Columbidae) from an archeological site on Lifuka, Tonga. *Proc. Biol. Soc. Washington* 102(3): 537-552.
- Steadman, D.W. (1991). The identity and taxonomic status of *Megapodius stairi* and *M. burnabyi* (Aves: Megapodiidae). *Proc. Biol. Soc. Washington* 104(4): 870-877.
- Steadman, D.W. (1992a). Birds from the To'aga site, Ofu, American Samoa: prehistoric loss of seabirds and megapodes. *Arch. Res. Facility Contr. Univ. California, Berkeley*.
- Steadman, D.W. (1992b). Extinct and extirpated birds from Rota, Mariana Islands. *Micronesica* 25(1): 71-84.
- Steadman, D.W. (1993). Biogeography of Tongan birds before and after human impact. *Proc. Natl. Acad. Sci. USA* 90: 818-822.
- Steadman, D.W. & Miller, N.G. (1987). California Condor associated with spruce-jack pine woodland in the late Pleistocene of New York. *Quaternary Research* 28: 415-426.
- Steadman, D.W., Pahlavan, D.S. & Kirch, P.V. (1990). Extinction, biogeography, and human exploitation of birds on Tikopia and Anuta, Polynesian outliers in the Solomon Islands. *Bishop Mus. Occas. Papers* 30: 118-153.
- Steadman, D.W., Stull, J. & Eaton, S.W. (1979). Natural history of the Ocellated Turkey. *J. World Pheasant Assoc.* 4: 15-37.
- Steen, J.B. & Unander, S. (1985). Breeding biology of the Svalbard Rock Ptarmigan *Lagopus mutus hyperboreus*. *Ornis Scand.* 16: 191-197.
- Steen, J.B., Erikstad, K.E. & Høidal, K. (1992). Cryptic behaviour in moulting hen Willow Ptarmigan *Lagopus l. lagopus* during snow melt. *Ornis Scand.* 23: 101-104.
- Steen, J.B., Pedersen, H.C., Erikstad, K.E., Hansen, K.B., Høidal, K. & Størdal, A. (1985). The significance of cock territories in Willow Ptarmigan. *Ornis Scand.* 16: 277-282.
- Steenhof, K. (1983). Activity patterns of Bald Eagles wintering in South Dakota. *J. Raptor Res.* 17: 57-62.
- Steenhof, K. (1992). *Snake River Bird of Prey Area Research and Monitoring. Annual report*. US Dept. Inter. Bur. Land Manage., Boise, Idaho.
- Steenhof, K. & Kochert, M.N. (1988). Dietary shifts of three raptor species to changing prey densities in a natural environment. *J. Anim. Ecol.* 57: 37-48.
- Steenhof, K., Kochert, M.N. & Koppe, J.A. (1993). Nesting by raptors and ravens on electrical transmission line towers. *J. Wildl. Manage.* 57: 271-281.
- Steffen, D.E., Cuvillier, C.E. & Hurst, G.A. (1990). Age determination of Eastern Wild Turkey gobblers. *Wildl. Soc. Bull.* 18(2): 119-124.
- Stegmann, B. (1937). Die geographischen Formen des Borkuhns. *J. Orn.* 80: 342-354.
- Stegmann, B. (1961). Zur Brutbiologie des Borkuhns (*Gypsetus barbatus*) in Tjan-Shan. *J. Orn.* 102: 68-74.
- Stellin, M. & Gifford, C.R. (1991). Growth and brood reduction in mallard ducks (*Anas platyrhynchos*). *Auk* 108: 130-131.
- Stellin, J. (1974). Die qualitative Beurteilung west-deutscher Auerhühnbiotopie unter besonderer Berücksichtigung der Grenzlinienwirkung. *All. Forst.* 39: 837-839.
- Steiner, H. (1945). Ueber die Lebensentwicklung der Zeiten Zuckommenschafts-Generation bei tierischen Anhängen. *Arch. Julius Klaus-Stift. Verh. Gesellsch. Sozialanthropol. Russen.* 20: 236-51.
- Stendell, R.C. (1972). *The Occurrence, Food Habits, and Nesting Strategy of White-nailed Kites in Relation to a Fluctuating Vole Population*. PhD thesis, University of California, Berkeley.
- Stendell, R.C. & Gilmer, D.S. (1988). Organochlorine and mercury residues in Swinson's and Ferruginous Hawk eggs collected in North and South Dakota. *Environ. Monitor. Assessment* 10: 37-41.

- Sunyer, C. & Horedia, R. (1991). [Differences between females of Hen Harrier *Circus cyaneus* and Pallid Harrier *Circus macrurus*]. *Limicola* 5(3): 125-128.
- Sunyer, C. & Viñuela, J. (1991). Sobre técnicas de caza y alimentación del Esmerejón (*Falco columbarius*) en I-paña. *Misc. Zool. (Barcelona)*, 15: 247-248.
- Survillo, A.V. (1983). [The Steppes Eagle in the area to the north-west of the Caspian Sea]. Pp. 74-77 in: [Conservation of birds of prey]. Moscow, In Russian.
- Sushkin, P. (1895). *Aquila glaucus*, Sev. (Biologische Skizze). *Bull. Soc. Imp. Nat. Moscou* 9: 371-390.
- Sushkin, P.P. (1938). [The birds of the Soviet Altai and the neighbouring parts of north-west Mongolia]. USSR Acad. Sci. Publ. Moscow and Leningrad. In Russian.
- Sutton, E. (1965). Zum Wachstum der Großflughühner (*Alectura* und *Megapodius*). *Orn. Beob.* 62: 43-60.
- Sutton, G.M. (1954). Blackish Crane-Hawk. *Wilson Bull.* 66(4): 237-242.
- Sutton, G.M. (1955). Great Curassow. *Wilson Bull.* 67: 75-77.
- Sutton, G.M. (1968). The natal plumage of the Lesser Prairie Chicken. *Auk* 85: 679.
- Sutton, G.M. & Burleigh, T.D. (1939). A list of the birds observed on the 1938 Semple Expedition to Southeastern Mexico. *Occ. Pap. Mus. Zool. Louisiana State Univ.* 3: 15-46.
- Sutton, G.M. & Parmelee, D.F. (1956). The Rough-legged Hawk in the American Arctic. *Arctic* 9: 202-207.
- Sutton, G.M. & Pettigill, O.S. (1942). Birds of the Gómez Farías region: southwestern Tamaulipas. *Auk* 59: 1-34.
- Sutton, G.M. & Phillips, A.R. (1942). June bird life of the Papago Indian Reservation, Arizona. *Condor* 44: 57-65.
- Sutton, I.D. (1955). Nesting of the Swallow-tailed Kite. *Everglades Nat. Hist.* 3: 72-84.
- Sutton, J.C., Sutton, A., Dewhurst, C.F. & Dewhurst, L.M. (1984). A confirmed breeding record for the Swallow-tailed Kite in the Rift Valley of Kenya. *East Afr. Nat. Hist. Soc. Bull.* 24: 12.
- Svedarsky, W.D. (1979). *Spring and Summer Ecology of Female Greater Prairie Chickens in Northwestern Minnesota*. PhD thesis, University of North Dakota, Grand Forks.
- Svedarsky, W.D. (1988). Reproductive ecology of female Greater Prairie Chickens in Minnesota. Pp. 193-239 in: Bergend & Grason (1988b).
- Svedarsky, W.D. & Wolfe, T. eds. (1973). *The Prairie Chicken in Minnesota*. University of Minnesota, Crookston.
- Svehlik, J. & Meyburg, B.U. (1979). Gelegergröße und Brutfolge des Schreiadlers (*Aquila pomarina*) und des Kaserndlers (*Aquila heliaca*) in den ostslowakischen Karpaten 1966-1978. *J. Orn.* 120: 406-415.
- Svensson, L. (1975). Större skrikörn *Aquila clanga* och mindre skrikörn *Aquila pomarina* - problemat att bestämma dem. *Vår Fågelvärld* 34: 1-26.
- Svensson, L. (1987). Underlying pattern of Steppe, Spotted and Lesser Spotted Eagles. Pp. 12-14 in: *International Bird Identification*. Proc. 4th International Identification Meeting, Eilat.
- Svoboda, F.J. & Gullion, G.W. (1972). Preferential use of aspen by Ruffed Grouse in northern Minnesota. *J. Wildl. Manage.* 36: 1166-1180.
- Swank, W.G. (1977). Food of three upland game birds in Selengi Area, Kajiado District, Kenya. *East Afr. Wildl. J.* 15: 99-105.
- Swank, W.G. & Gallizoli, S. (1954). The influence of hunting and rainfall upon Gambel's Quail populations. *Trans. North Amer. Wildl. Nat. Resour. Conf.* 19: 283-296.
- Swann, H.K. (1922). *Synopsis of the Accipitres (Diurnal Birds of Prey)*. Wheldon & Wesley, London.
- Swann, H.K. (1924-1945). *Monographs of the Birds of Prey (Order Accipitres)*. 2 Vols. (1930, 1945). Parts 1-16. Wheldon & Wesley, London.
- de Swardt, D.H. (1990a). Growth and behaviour of Secretary Bird nestlings. *Gabari* 5: 22.
- de Swardt, D.H. (1990b). Pygmy Falcon catches Sociable Weaver in flight. *Gabari* 5: 27.
- Swarth, H.S. (1909). Distribution and molt of Meams Quail. *Condor* 11: 39-43.
- Swatschek, I., Feldmann, E., Ristow, D., Scharlau, W., Wink, C. & Wink, M. (1994). DNA fingerprinting of Eleonora's Falcon *Falco eleonorae*. In: Meyburg & Chancellor (1994a).
- Schwetckel, I., Ristow, D., Scharlau, W., Wink, C. & Wink, M. (1993). [Population genetics and paternity analysis of Eleonora's Falcon *Falco eleonorae*]. *J. Orn.* 134(2): 137-143.
- Sweeney, J.E. ed. (1980). *Proceedings of the Fourth National Wild Turkey Symposium*. National Wild Turkey Federation, Edgefield, South Carolina, USA.
- Sweet, M.J. (1986). *Mississippi Kite Winter Nest Survey, 1985*. Special Report, Illinois Department of Conservation, Springfield.
- Sweet, M.J. (1991). Kites and Northern Harriers. Pp. 32-41 in: Pendleton, B.G. & Krahe, D.L. eds. (1991). *Proceedings of the Midwest Raptor Management Symposium and Workshop*. National Wildlife Federation Technical Series 15. Washington, D.C.
- Swen, T.R., McIntyre, C., Ritchie, R.J., Bente, P.J. & Rosenau, D.G. (1994). Distribution, abundance, and notes on the breeding biology of Gyrfalcons *Falco rusticolus* in Alaska. In: Meyburg & Chancellor (1994a).
- Swen, T.R., White, C.M. & Ritchie, R.J. (1992). Comments on the status of certain birds on the North Slope of Alaska. *Northwestern Naturalist* 73: 84-87.
- Swenson, J. (1979). The relationship between prey species ecology and dive success in Ospreys. *Auk* 96: 408-413.
- Swenson, J.E. (1985). Seasonal habitat use by Sharp-tailed Grouse, *Tympanuchus phasianellus*, on a mixed-grass prairie in Montana. *Can. Field-Nat.* 99: 40-46.
- Swenson, J.E. (1991a). *Social Organization of Hazel Grouse and Ecological Factors Influencing it*. PhD thesis, University of Alberta, Edmonton.
- Swenson, J.E. (1991b). Evaluation of a density index for territorial male Hazel Grouse *Bonasa bonasia* in spring and autumn. *Ornis Fenn.* 68: 57-65.
- Swenson, J.E. (1991c). Is the Hazel Grouse a poor disperser? *Trans. Congr. Internat. Union Game Biol., Hungary*, 1991: 20: 347-352.
- Swenson, J.E. (1992). Relative Altersbestimmung bei adulten Haselhühner (*Bonasa bonasia*). *J. Orn.* 133: 209-212.
- Swenson, J.E. (1993). The importance of alder to Hazel Grouse in Fennoscandian boreal forest: evidence from four levels of scale. *Ecography* 16: 37-46.
- Swenson, J.E. & Andreev, A.V. (1991). Different Hazel Grouse winter social organization in the Eastern and Western Palearctic. *Trans. Congr. Internat. Union Game Biol.* 19: 101.
- Swenson, J.E. & Boag, D.A. (1993). Are Hazel Grouse *Bonasa bonasia* monogamous? *Ibis* 135(4): 463-467.
- Swenson, J.E. & Danielson, J. (1991). Workshop summary: status and conservation of the Hazel Grouse in Europe. *Ornis Scand.* 22: 297-298.
- Swenson, J.E. & Olsson, B. (1991). Hazel Grouse night roost site preferences when snow-roosting is not possible in winter. *Ornis Scand.* 22: 284-286.
- Sych, V.F. (1900). *Morphology of the Locomotory Apparatus of Galliform Birds*. PhD thesis, Kazan' University.
- Sych, V.F. & Bogdanovich, L.A. (1988). [Morphological characteristics of extensor digitorum longus in some birds]. In Russian, with English summary. *Vestnik Zoologii* 3(1): 68-75.
- Sykes, P.W. (1979). Status of the Everglade Kite in Florida 1968-1978. *Wilson Bull.* 91(4): 495-511.
- Sykes, P.W. (1983a). Recent population trend of the Snail Kite in Florida and its relationship to water levels. *J. Field Orn.* 54(3): 237-246.
- Sykes, P.W. (1983b). Snail Kite use of the freshwater marshes of south Florida. *Florida Field Nat.* 11: 73-87.
- Sykes, P.W. (1984). The range of the Snail Kite and its history in Florida. *Bull. Florida State Mus. (Biol. Sci.)* 29(6): 211-264.
- Sykes, P.W. (1985a). Evening roosts of the Snail Kite in Florida. *Wilson Bull.* 97(1): 57-70.
- Sykes, P.W. (1985b). Pesticide concentrations in Snail Kite (*Rostrhamus sociabilis*) eggs and nestlings in Florida. *USA Condor* 87(3): 438.
- Sykes, P.W. (1987). The feeding habits of the Snail Kite in Florida, USA. *Colonial Waterbirds* 10(1): 84-92.
- Sykes, P.W. & Kale, H.W. (1974). Everglade Kites feed on non-snail prey. *Auk* 91: 818-821.
- Sylvén, M. (1977a). Age determination of Red Kite *Milvus milvus* and Black Kite *Milvus migrans*. *Vår Fågelvärld* 36: 38-44.
- Sylvén, M. (1977b). Hybridisation between Red Kite *Milvus milvus* and Black Kite *Milvus migrans* in Sweden in 1976. *Vår Fågelvärld* 36: 38-44.
- Sylvén, M. (1987). Interspecific relations between sympatrically wintering Common Buzzards *Buteo buteo* and Rough-legged Buzzards *Buteo lagopus*. *Ornis Scand.* 9: 197-206.
- Szuba, K.J. (1989). *Comparative Population Dynamics of Hudsonian Spruce Grouse in Ontario*. PhD thesis, University of Toronto, Ontario.
- Szuba, K.J. & Bendell, J.F. (1982). Population densities and habitats of Spruce Grouse in Ontario. Pp. 199-213 in: Wein, R.W., Riewe, R.R. & Methuen, I.R. eds. (1982). *Resources and Dynamics of the Boreal Forest*. Association of Canadian Universities for Northern Studies, Ottawa.
- Szuba, K.J. & Bendell, J.F. (1984). Weights of Ontario Spruce Grouse by sex, age, and breeding success. *Can. J. Zool.* 62: 788-792.
- Szuba, K.J. & Bendell, J.F. (1988). Non-territorial males in populations of Spruce Grouse. *Condor* 90: 492-496.
- Tachikawa, S. (1975). *Feeding of Buteo lagopus in Japan*. *Ibis* 114: 401-43.
- Taczanowski, L. (1884-1886). *Ornithologie en Perou*. Oberthur, Paris.
- Taipei, A.M. (1940). [Captive breeding of Great Curassow]. *Riv. Ital. Orn.* 10: 93-126. In Italian.
- Taipei, A.M. (1950). Genesi della *Crux "viridissima"* (= *albata* x *rubra*). *Boll. Zool.* 17(Suppl.): 543-547.
- Taipei, A.M. (1953). Riproduzione in cattività di *Penelope superciliosa* e *Oriolus galera*. *Riv. Ital. Orn.* 23: 85-122.
- Taipei, A.M. (1955). Uccelli del Guatemala con speciale riguardo alla regione del Peten raccolti dal Maggio al Settembre 1932. *Atti. Soc. Italiana Sci. Nat.* 94: 15-84.
- Taipei, A.M. (1956). La morte di una femmina di Crax globulosa (*Crax globulosa*) all'età di 24 anni e 4 mesi. *Zoo. Bollettino dei Giardini Zoologici di Milano e Torino* 2(3): 86-89.
- Taipei, A.M. (1957). Riproduzione in cattività di *Penelope superciliosa* e *Penelope pileata*. *Zoo. Bollettino dei Giardini Zoologici di Milano e Torino* 3(1): 3-28.
- Taipei, A.M. (1961). Analogie fisiologiche nel settore riproduttivo tra *Afrapavo Chapin* e *Penelope* Merrem. *Natura*, Milano 52: 57-64.
- Taipei, A.M. (1965). Sistematica della famiglia "Cracidae". *Arch. Zool. Italiano* 50: 163-231.
- Taipei, A.M. (1968). Osservazioni sulla riproduzione e allevamento di *Pipile jacutinga* (Spix) (Cracidae-Galliformes) realizzata per la prima volta con esemplari in cattività. *Ann. Civ. Mus. Stor. Nat. Genova* 77: 33-52.
- Taipei, A.M. (1969a). [Nesting in captivity of *Mitu tuberosa*]. *Univ. Bologna Publ.* 26: 1-26.
- Taipei, A.M. (1969b). [On *Nothocrax urumutum*]. *Riv. Ital. Orn.* 39: 38-48.
- Tait, C.C. (1989). Observations on a brood of Coqui Francolins, *Birding in SA* 41: 70-72.
- Taka-Tsukasa, N. (1967). *The Birds of Nippon*. Maruzen, Tokyo.
- Taka-Tsukasa, N. & Kano, T. (1939). An investigation on the altitudinal distribution of birds in the Tsugitaka (Tzekao-Shan) mountain range in Formosa. *Tori* 10: 545-587.
- Takada, T. (1956). Nesting records of the Japanese Sparrowhawk at Mt Fuji. *Tori* 14: 25-27.
- Takada, K. (1989). [Migration of hawks in Japan]. *Strix* 8: 35-123. In Japanese with English summary.
- Takekawa, J.E. & Beissinger, S.R. (1983). First evidence of Snail Kites feeding on the introduced snail *Pomacea bridgesi* in Florida. *Florida Field Nat.* 11: 107-108.
- Takekawa, J.E. & Beissinger, S.R. (1989). Cyclic drought, dispersal, and the conservation of the Snail Kite in Florida: lessons in critical habitat. *Conserv. Biol.* 3: 302-311.
- Tammur, R. & Randall, T. (1994). The White-tailed Eagle *Haliaeetus albicilla* Population and Breeding Productivity in Estonia. In: Meyburg & Chancellor (1994a).
- Tan Yao-kuang & Wu Zhi-kang (1981). A new subspecies of the Silver Pheasant from Guizhou, China - *Lophura nycthemera rongjiangensis*. *Zool. Res.* 2(4): 303-305.
- Tang Chan-zhu (1990). The distribution of pheasants and partridges in China. Pp. 16-17 in: Hill *et al.* (1990).
- Tang Ze-sheng & Dai Hong-zhen (1960). Ecology of the Bamboo Partridge *Bambusicola thoracica* and methods of hunting it. *Chinese J. Zool.* 4(7): 301-304.
- Tapfer, D. (1973). Der Kaiseradler in Pannonien. *Falke* 20: 402-407.
- Tappe, S.C. (1992). *Game Heritage: an Ecological Review from Shooting and Gamekeeping Records*. Game Conservancy Trust, Fordingbridge.
- Tarboton, W.R. (1976). Martial Eagles: an unusual breeding episode. *Bokmakierie* 28: 29-32.
- Tarboton, W.R. (1977a). Food consumption and pellet production in the Black-shouldered Kite *Elanus caeruleus*. *Zoologica Africana* 12: 252-256.
- Tarboton, W.R. (1977b). Nesting, territoriality and food habits of Wahlberg's Eagle. *Bokmakierie* 29: 46-50.
- Tarboton, W.R. (1978a). Breeding of the Little Banded Goshawk. *Ostrich* 49: 132-143.
- Tarboton, W.R. (1978b). Hunting and the energy budget of the Black-shouldered Kite. *Condor* 80: 88-91.
- Tarboton, W.R. (1984). Behavior of the African Peregrine during incubation. *J. Raptor Res.* 18: 131-136.
- Tarboton, W.R. (1986). Wahlberg's Eagles decline at Nylsvlei. *Afr. Wildl.* 40: 39.
- Tarboton, W.R. & Allan, D.G. (1984). The status and conservation of birds of prey in the Transvaal. *Transvaal Museum Monograph* 3. Transvaal Museum, Pretoria.
- Tarboton, W.R., Kemp, A.C. & Lewis, M. (1978). The status of the Black Sparrowhawk in Transvaal. *Bokmakierie* 30: 56-59.
- Tarboton, W.R., Kemp, M.I. & Kemp, A.C. (1987). *Birds of the Transvaal*. Transvaal Museum, Pretoria.
- Tarburton, M.K. (1991). The feeding technique of the Australian Hobby. *Austr. Bird Watcher* 14: 148-149.
- Tarmudji, I. (1978). Burung Maleo. *Suara Alam* 3: 26-28.
- Tarr, H.E. (1962). Observations on the White-breasted Sea-eagle. *Austr. Bird Watcher* 1: 194-196.
- Tarr, H.E. (1965). The Malleefowl in Wyperfeld National Park. *Austr. Bird Watcher* 2: 140-144.
- Taverner, P.A. (1927). A study of *Buteo borealis*, the Red-tailed Hawk, and its varieties in Canada. *Bull. Victoria Mem. Mus.* 48: 1-21.
- Taylor, J.A. (1975). The Northern Helmeted Curassow *Pauxi pauxi*. *Avicult. Mag.* 81: 195-196.
- Taylor, K. (1977). New Zealand Falcon eating carrion. *Notornis* 24: 195-196.
- Taylor, M. (1988). *The White-breasted Guineafowl in South-east Liberia*. Unpublished report to World Pheasant Association and Royal Ontario Museum.
- Taylor, M.A. (1979). Lesser Prairie Chicken use of man-made leks. *Southwestern Naturalist* 24: 706-707.
- Taylor, M.A. & Guthery, F.S. (1980). *Status, Ecology and Management of the Lesser Prairie Chicken*. US For. Serv. Gen. Tech. Rep. RM-77.
- Taynton, K.M. (1984). *Palawan Peacock Pheasant Polyplectron enphumum* at the Jersey Wildlife Preservation Trust. *Dodo, J. Jersey Wildlife Preservation Trust* 21: 79-92.
- Teidoff, E. (1951). Zur Ökologie, Biologie und Psychologie des Haselhühns. *Bonn. zool. Beitr.* 2: 99-108.
- Teixeira, D.M. (1986). The avifauna of the north-eastern Brazilian Atlantic forests: a case of mass extinction? *Ibis* 128: 167-168.
- Teixeira, D.M. & Antas, P.T.Z. (1981). Notes on endangered Brazilian Cracidae. Pp. 176-189 in: Eschillo López (1981).
- Teixeira, D.M. & Sick, H. (1981). Notes on Brazilian Cracidae: the Red-billed Curassow, *Crax blumenbachii* Spix, 1825, and the Wattled Curassow, *Crax globulosa* Spix, 1825. *Bol. Mus. Nat. Rio de Janeiro* 35: Zool. no. 299.
- Teixeira, D.M. & Sick, H. (1986). Plumage variation and plumage aberration in Cracidae. *Rev. Brasil. Biol.* 46(4): 777-779.
- Teixeira, D.M. & Snow, D.W. (1982). Notes on the nesting of the Red-billed Curassow *Crax blumenbachii*. *Bull. Brit. Orn. Club* 102: 83-84.
- Teixeira, D.M., Nacinovic, J.B. & Luig, G. (1988). Notes on some birds of northeastern Brazil (3). *Bull. Brit. Orn. Club* 108(2): 75-79.
- Teixeira, D.M., Nacinovic, J.B. & Pontual, F.B. (1987a). Notes on some birds of northeastern Brazil (2). *Bull. Brit. Orn. Club* 107(4): 151-157.
- Teixeira, D.M., Nacinovic, J.B. & Pontual, F.B. (1987b). Sobre a redescoberta de *Leptodon forbesi* (Swann, 1922) no nordeste do Brasil. Page 148 in: *XIV Congresso Brasileiro de Zoologia* in Juiz de Fora, Brasil.
- Tella, J.L. (1993). Polyandrous trios in a population of Egyptian Vultures (*Neophalm perennopterus*). *J. Raptor Res.* 27: 119-120.
- Telpov, V.A. & Bitarov, V.N. (1986). [The Imperial Eagle in the south of Stavropol'ye]. Pp. 117-118 in: [Rare and Endangered Species of Plants and Animals, Floristical and Faunistical Complexes of the Northern Caucasus in Need of Protection]. Stavropol. In Russian.
- Temple, J. & Cocker, M. (1991). A nest of Caucasian Black Grouse *Tetrao ilakosiewiczii* in Turkey. *Sandgrouse* 13(2): 102-103.
- Temple, S.A. (1972a). Systematics and evolution of North American Merlins. *Auk* 89: 325-338.
- Temple, S.A. (1972b). Sex and age characteristics of North American Merlins. *Bird Banding* 43: 191-196.
- Temple, S.A. (1974a). Wildlife in Mauritius today. *Ornis* 12: 584-590.
- Temple, S.A. (1974b). Project 986: Western Indian Ocean island raptors conservation. *WWF Yearbook (1973-1974)*: 201-204.
- Temple, S.A. (1977). The status and conservation of endemic kestrels in the Indian Ocean islands. Pp. 78-82 in: *Proc. World Conference of Birds of Prey*, Vienna. ICBP, Cambridge.
- Temple, S.A. (1986). Recovery of the endangered Mauritius Kestrel from an extreme population bottleneck. *Auk* 103: 632-633.
- Temple, S.A. (1987). Feeding ecology of the Mauritius Kestrel (*Falco punctatus*). *Biotropica* 19: 2-6.
- Temple, S.A. & Wallace, M.P. (1989). Survivorship patterns in a population of Andean Condors *Vultur gryphus*. Pp. 247-251 in: Meyburg & Chancellor (1989).
- Teplav, V.P. (1947). [The Capercaillie in the Pechora-Ilych sanctuary]. *Trudy Pechora-Ilychskogo zapovednika* 4: 3-76.
- Terborgh, J.W. (1983). *Five New World Primates: A Study in Comparative Ecology*. Monographs in Behavior and Ecology (eds. Krebs, J.R. & Clutton-Brock, T.), Princeton University Press, Princeton.
- Terborgh, J.W. (1986). Community aspects of frugivory in tropical forests. Pp. 371-384 in: Estrada, A. & Fleming, T.H. eds. *Frugivores and Seed Dispersal*. Dr. Junk Publishers, Boston.
- Terborgh, J.W. & Weske, J.S. (1975). The role of competition in the distribution of Andean Birds. *Ecology* 56: 562-576.
- Terborgh, J.W., Fitzpatrick, J.W. & Emmons, L. (1984). Annotated checklist of bird and mammal species of Cocha Casu Biological Station, Manu National Park, Peru. *Fitchiana Zool. New Ser.* 21: 1-29.
- Terrasse, J.F. (1977). Matinée sexuelle du Vautour fauve, premières données obtenues dans la nature. *Orseum et RFO* 47(2): 214-218.
- Terrasse, J.F. (1985). The effects of artificial feeding on Griffon, Bearded and Egyptian Vultures in the Pyrenees. Pp. 429-430 in: Newton & Chancellor (1985).

- Terrasse, J.F. & Terrasse, M. (1977). The Osprey in the western Mediterranean: distribution, census, reproduction, threats. *Nos Oiseaux* 34: 111-127.
- Terrasse, J.F., Terrasse, M., & Budoit, Y. (1961). Observations sur la reproduction du Vautour fauve, du Percinoptère et du Gypaète barbu dans les Basses-Pyrénées. *Alauda* 28(4): 241-257, 29(1): 1-24.
- Terrasse, M. (1983). The status of vultures in France. In: Wilbur & Jackson (1983).
- Terrasse, M. & Thauront, M. (1988). The vultures of Mali. *Vulture News* 20: 4-7.
- Terrasse, M., Bagnolini, C., Bonnet, J., Pinna, J.L., & Sarrazin, F. (1994). Reintroduction of the Griffon Vulture *Gyps fulvus* in the Massif Central, France. In: Meyburg & Chancellor (1994a).
- Terres, J.K. (1980). *The Audubon Society Encyclopedia of North American Birds*. Alfred A. Knopf, New York.
- van Tets, G.F. (1974). A revision of the fossil Megapodidae (Aves), including a description of a new species of *Progruta* de Vis. *Trans. R. Soc. S. Austr.* 98: 213-224.
- Tewes, E. (1994). The European Black Vulture *Aegypius monachus* Project in Mallorca. In: Meyburg & Chancellor (1994a).
- Tewes, M.E. (1984). Opportunistic feeding by White-tailed Hawks at prescribed burns. *Wilson Bull.* 96(1): 135-136.
- Thaler, E. (1983). Beobachtungen zur Brutbiologie des Alpensechshehns (*Lagopus mutus helveticus*) im Alpenzoo Innsbruck. *Zool. Garten N.F.* 53: 101-123.
- Thaler, E. & Pechlaner, H. (1980). Caisins in the Lammergeier or Bearded Vulture *Gypaetus barbatus aureus* in Innsbruck Alpenzoo. *Int. Zoo Yb.* 20: 278-280.
- Thaler, E., Maschler, S., & Steinkellner, V. (1986). Vergleichende Studien zur Postembryonalentwicklung dreier Altweltgeier: Bartgeier, Schamitzgeier und Gamsgeier. *Ann. Naturhist. Mus. Wien.* 88-89B: 361-376.
- Theberge, J.B. (1971). *Population Fluctuations and Changes in the Quality of Rock Ptarmigan in Alaska*. PhD thesis, University of British Columbia, Vancouver.
- Theberge, J.B. & Bendell, J.F. (1980). Differences in survival and behaviour of Rock Ptarmigan (*Lagopus mutus*) chicks among years in Alaska. *Can. J. Zool.* 58: 1638-1642.
- Theberge, J.B. & Gauthier, D.A. (1982). Factors influencing densities of territorial male Ruffed Grouse, Algonquin Park, Ontario. *J. Wildl. Manage.* 46: 263-268.
- Theberge, J.B. & West, G.C. (1973). Significance of brooding to energy demands of Alaskan Rock Ptarmigan chicks. *Arctic* 26: 138-148.
- Thomido, A. (1937). Un nouveau *Francolinus* de l'Angola. Pp. 1833-1834 in: C. R. XXII Congr. Int. Zool. Lisbon 1935.
- Théry, M., Éraud, C., & Sabatier, D. (1992). Les fruits dans le régime alimentaire de *Penelope murai* (Aves, Cracidae) en Forêt Guyanaise: frugivorie stricte ou sélective? *Rev. Ecol. (Terre Vie)* 47: 383-401.
- Thevenot, M., Beaurun, P., & Bergier, P. (1981). Statut et évolution de la population de Faucon d'Éléonore *Falco eleonorae* au Maroc. *Ann. Centre Rech. Orn. Provence* 1: 111-115.
- Thibault, J.C. & Guyot, I. (1988). *Le Livre Rouge des Oiseaux Menacés des Régions Françaises d'Outre-Mer*. ICBP, Saint-Cuc, France.
- Thibault, J.C. & Patrimoine, O. (1991). Some aspects of the breeding success of the Osprey in Corsica, West Mediterranean. *Bird Study* 38: 98-102.
- Thibault, J.C., Vigne, J.D., & Torre, J. (1993). The diet of young Lammergeiers *Gypaetus barbatus* in Corsica: its dependence on extensive grazing. *Ibis* 135(1): 42-48.
- Thiollay, J.M. (1963). Notes sur le régime alimentaire du Faucon crécerelle *Falco tinnunculus* en hiver. *Nos Oiseaux* 21: 71-73.
- Thiollay, J.M. (1967a). Ecologie d'une population de rapaces diurnes en Lorraine. *Rev. Ecol. (Terre Vie)* 21: 116-183.
- Thiollay, J.M. (1967b). Essai sur les rapaces du Midi de la France. distribution-écologie, tentative de dénombrement. Aigle de Bonelli, *Hieraaetus fasciatus* (Viellot). *Alauda* 35: 140-150.
- Thiollay, J.M. (1968a). Notes sur les rapaces diurnes de Corse. *Oiseau et RFO* 38: 187-208.
- Thiollay, J.M. (1968b). Particularités du plumage chez les Gypaètes corse (*Gypaetus barbatus aureus*) *Alauda* 36: 211.
- Thiollay, J.M. (1970). Observations sur l'écologie d'une population de Buzard des roseaux, *Circus aeruginosus*, en Camargue. *Nos Oiseaux* 30: 214-220.
- Thiollay, J.M. (1971). L'avifaune de la région de Lamto (moyenne Côte d'Ivoire). *Ann. Univ. Abidjan, sér. E. Ecol. IV(1)*: 5-135.
- Thiollay, J.M. (1973a). Recherches écologiques dans la savane le Lamto (Côte d'Ivoire): le peuplement avien. Essai d'étude quantitative. *Rev. Ecol. (Terre Vie)* 1: 108-144.
- Thiollay, J.M. (1973b). Place des oiseaux dans les chaînes trophiques d'une zone préforestière en Côte d'Ivoire. *Alauda* 61: 273-300.
- Thiollay, J.M. (1975a). Les rapaces d'une zone de contact savane-forêt en Côte d'Ivoire. 1. Présentation du peuplement. *Alauda* 43: 75-102.
- Thiollay, J.M. (1975b). Les rapaces d'une zone de contact savane-forêt en Côte d'Ivoire. 2. Densité, dynamique et structure du peuplement. *Alauda* 43: 387-416.
- Thiollay, J.M. (1975c). Les rapaces des parcs nationaux de Côte d'Ivoire. Analyse du peuplement. *Oiseau et RFO* 45: 241-257.
- Thiollay, J.M. (1975d). Migrations de rapaces africaines en Ouganda et au Rwanda. *Oiseau et RFO* 45: 192-194.
- Thiollay, J.M. (1976a). Besoins alimentaires quantitatifs de quelques oiseaux tropicaux. *Rev. Ecol. (Terre Vie)* 30: 229-245.
- Thiollay, J.M. (1976b). Les rapaces d'une zone de contact savane-forêt en Côte d'Ivoire. 3. Modalités et succès de la reproduction. *Alauda* 44(3): 275-300.
- Thiollay, J.M. (1976c). Notes sur les oiseaux du Nord du Yémen. *Oiseau et RFO* 46: 261-265.
- Thiollay, J.M. (1977a). Distribution saisonnière des rapaces diurnes en Afrique occidentale. *Oiseau et RFO* 47: 25-85.
- Thiollay, J.M. (1977b). Le peuplement de Falconiformes d'une savane ougandaise: structure et fluctuations à court terme. *Oiseau et RFO* 47: 47.
- Thiollay, J.M. (1977c). Les rapaces d'une zone de contact savane-forêt en Côte d'Ivoire. 4. Modes d'exploitation du milieu. *Alauda* 45: 197-218.
- Thiollay, J.M. (1977d). La migration d'automne sur la côte orientale du Mexique. *Alauda* 45: 344-346.
- Thiollay, J.M. (1978a). Les rapaces d'une zone de contact savane-forêt en Côte d'Ivoire. 5. Spécialisations alimentaires. *Alauda* 46: 147-170.
- Thiollay, J.M. (1978b). Population structure and seasonal fluctuations of the Falconiformes in Uganda National Parks. *East Afr. Wildl. J.* 16: 145-152.
- Thiollay, J.M. (1978c). Les migrations de rapaces en Afrique Occidentale: adaptations écologiques et fluctuations saisonnières de production des écosystèmes. *Rev. Ecol. (Terre Vie)* 32: 89-133.
- Thiollay, J.M. (1978d). Distribution des Falconiformes nicheurs autour du massif de l'Annapurna (Himalaya Central). *Oiseau et RFO* 48: 291-310.
- Thiollay, J.M. (1980a). Spring hawk migration in eastern Mexico. *J. Raptor Res.* 14: 13-20.
- Thiollay, J.M. (1980b). Stratégies d'exploitation par les rapaces d'un écosystème herbacé néotropical. *Alauda* 48(4): 221-254.
- Thiollay, J.M. (1981). Feeding ecology and activity budget of a population of African Fish-eagles *Haliaeetus vocifer*. *Rev. Ecol. (Terre Vie)* 35: 537-562.
- Thiollay, J.M. (1984). Raptor community structure of a primary rain forest in French Guiana and effect of human hunting pressure. *J. Raptor Res.* 18: 117-122.
- Thiollay, J.M. (1985a). Birds of prey in French Guiana - a preliminary survey. *Bull. World Working Group on Birds of Prey* 2: 1-15.
- Thiollay, J.M. (1985b). Composition of falconiform communities along successional gradients from primary forest to secondary habitats. Pp. 181-190 in: Newton & Chancellor (1985).
- Thiollay, J.M. (1985c). Species diversity and comparative ecology of rainforest Falconiformes on three continents. Pp. 167-179 in: Newton & Chancellor (1985).
- Thiollay, J.M. (1985d). The birds of Ivory Coast: status and distribution. *Malinibus* 7(1): 1-59.
- Thiollay, J.M. (1985e). The West African forest avifauna: a review. In: Diamond & Lovejoy (1985).
- Thiollay, J.M. (1989a). Area requirements for the conservation of rain forest raptors and game birds in French Guiana. *Conserv. Biol.* 3(2): 128-137.
- Thiollay, J.M. (1989b). Consensus of diurnal raptors in a primary rain forest: comparative methods and species detectability. *J. Raptor Res.* 23(3): 72-84.
- Thiollay, J.M. (1989c). Distribution and ecology of Palearctic birds of prey wintering in West and Central Africa. Pp. 95-108 in: Meyburg & Chancellor (1989).
- Thiollay, J.M. (1991a). Altitudinal distribution and conservation of raptors in southwestern Colombia. *J. Raptor Res.* 25(1): 1-8.
- Thiollay, J.M. (1991b). Foraging, home range use, and social behavior of a group-living rainforest raptor, the Red-throated Caracara, *Daptrius americanus*. *Ibis* 133(4): 382-393.
- Thiollay, J.M. (1991c). *Les rapaces de la forêt tropicale*. Association pour la conservation des rapaces de la Nouvelle Calédonie. The White-bellied Goshawk *Accipiter hypoleucos* and the Brown Goshawk *A. fuscatus*. *Ibis* 133(4): 237-246.
- Todd, C.S. (1989). Notes on the immature specimens of Hagg, Great Horned Owl, and Great Horned Owl. *World Working Group on Birds of Prey News* 18: 10.
- Thiollay, J.M. & Clabert, J. (1990). Comparative foraging adaptations of small raptors in a dense African savanna. *Ibis* 132: 42-57.
- Thiollay, J.M. & Meyburg, B.U. (1981). Remarques sur l'organisation d'un peuplement insulaire de rapaces. *Madagascan. Alauda* 49: 216-226.
- Thiollay, J.M. & Meyburg, B.U. (1988). Forest fragmentation and the conservation of raptors: a survey on the island of Java. *Bull. Conserv.* 44: 229-250.
- Thiollay, J.M. & Meyer, J.A. (1978). Densité, taille des territoires et production dans une population d'Aigles pêcheurs, *Haliaeetus vocifer* (Daudin). *Rev. Ecol. (Terre Vie)* 32: 203-220.
- Thomaides, C., Vavalekas, C., & Papaevangelou, E. (1992). Nest-site characteristics and nest success of the Rock Partridge (*Alectoris graeca*). Page 886 in: Birkan, Pons et al. (1992). Abstract only.
- Thomas, B.T. (1979). The birds of a ranch in the Venezuelan llanos. Pp. 213-232 in: Eisenberg, J.I. ed (1979). *Vertebrate Ecology of the Northern Neotropics*. Smithsonian Institution Press, Washington, D.C.
- Thomas, E.S. (1928). Nesting of the Black Vulture in Hocking County, Ohio. *Ohio State Mus. Ser. Bull.* 1: 29-35.
- Thomas, J.W. (1964). Diagnosed diseases and parasitism in Rio Grande Wild Turkeys. *Wilson Bull.* 76(3): 292.
- Thomas, J.W., Hoozer, C.A., & Marburger, R.G. (1966). Winter concentrations and seasonal shifts in range of the Rio Grande Turkey. *J. Wildl. Manage.* 30(1): 34-39.
- Thomas, V.G. (1982). Energetic reserves of Hudson Bay Willow Ptarmigan during winter and spring. *Can. J. Zool.* 60: 1618-1623.
- Thomas, V.G. (1984). Winter diet and intestinal proportions of Rock and Willow Ptarmigan and Sharp-tailed Grouse in Ontario. *Can. J. Zool.* 62: 2258-2263.
- Thomas, V.G. (1987). Similar winter energy strategies of grouse, hares and rabbits in northern biomes. *Oikos* 206-212.
- Thomas, V.G. & Popko, R. (1981). Fat and protein reserves of wintering and prebreeding Rock Ptarmigan from south Hudson Bay. *Can. J. Zool.* 59: 1205-1211.
- Thomas, V.G., Lumsden, H.G., & Price, D.H. (1975). Aspects of winter metabolism of Ruffed Grouse (*Bonasa umbellus*) with special reference to energy reserves. *Can. J. Zool.* 53: 434-440.
- Thompson, F.R. & Fritzell, E.K. (1988). Ruffed Grouse winter roost site preference and influence of energy demands. *J. Wildl. Manage.* 52: 454-460.
- Thompson, F.R. & Fritzell, E.K. (1989a). Habitat use, home range, and survival of territorial male Ruffed Grouse. *J. Wildl. Manage.* 53: 15-20.
- Thompson, F.R. & Fritzell, E.K. (1989b). Habitat differences between perennial and transient drumming sites of Ruffed Grouse. *J. Wildl. Manage.* 53: 820-823.
- Thompson, F.R., Freiling, D.A., & Fritzell, E.K. (1987). Drumming, nesting, and brood habitat of Ruffed Grouse in an oak-hickory forest. *J. Wildl. Manage.* 51: 568-575.
- Thompson, L.E. (1976). Methods of sexing eared-pheasants. *Avicult. Mag.* 82: 39-50.
- Thomsen, P. & Jacobsen, P. (1979). *The Birds of Tunisia*. Nature-Travel, Copenhagen.
- Thompson, P.S., Thompson, M.L.P. & Thompson, D.B.A. (1987). Chiff nesting Merlins in north-west Sutherland. *Scottish Birds* 15: 183-184.
- Thomsett, S. (1988). Can Crowned Eagles be sexed by plumage alone? *Gahar* 3: 70-72.
- Thomsett, S. (1991a). Notes on the status and behaviour of Black Sparrowhawks in Kenya. *Gahar* 6: 27-28.
- Thomsett, S. (1991b). Polyandrous Pygmy Falcon? *Gahar* 6: 73.
- Thomson, A.L. & Moreau, R.E. (1957). Feeding habits of the Palm-nut Vulture *Gypohierax*. *Ibis* 99: 608-613.
- Thomson, W.R. (1975). Notes on the Bat-hawk in Rhodesia. *Bokmakere* 27: 52-53.
- Thomson, W.R. (1984). DDT in Zimbabwe. Pp. 169-172 in: Mendelsohn, J.M. & Sapsford, C.W. eds (1984). *Pesticides and the Environment*. Natal Bird Club, Durban.
- Thornhill, L.W. (1981). Eggshells of the Imperial Eagle *Pernis ptilorhynchus*. *J. World Pheasant Assoc.* 6: 53-57.
- Thornhill, R. (1988). The jungle owl hen's cackle incites male competition. *Verh. Dtsch. Zool. Ges.* 81: 145-154.
- Thorstorn, R.K. (1989). Breeding biology, behavior, and home range of the Barred Forest-falcon (*Micrastur ruficollis*). Pp. 81-91 in: Burnham et al. (1989).
- Thorstorn, R.K. (1990a). Breeding biology of the Barred Forest-falcon (*Micrastur ruficollis*). Pp. 145-148 in: Burnham et al. (1990).
- Thorstorn, R.K. (1990b). Breeding biology of the Collared Forest-falcon (*Micrastur semitorquatus*). Pp. 345-352 in: Burnham et al. (1990).
- Thorstorn, R.K. (1993a). Breeding Ecology of the Collared Forest-falcon (*Micrastur semitorquatus*). MSc thesis, Boise State University, Boise, Idaho.
- Thorstorn, R.K. & Morales, C.M. (1993). Breeding biology, food habits, and home range of the Barred Forest-falcon (*Micrastur ruficollis*) in Guatemala. *J. Raptor Res.* 27(1): 83.
- Thorstorn, R.K., Castillo, J.M., & Castillo, A. (1991). Breeding biology of the Bicolored Hawk (*Accipiter bicolor*). Pp. 73-75 in: Whiteaker et al. (1991).
- Thorstorn, R.K., Morales, C.M., & Mateo, C.S. (1992). Breeding biology, home range, and population dynamics of the Barred Forest-falcon in Tikal National Park. Pp. 201-208 in: Whiteaker & Thorstorn (1992).
- Thorstorn, R.K., Quichán, A.M., & Morales, C.M. (1991). Breeding biology of the Barred Forest-falcon (*Micrastur ruficollis*). Pp. 121-126 in: Whiteaker et al. (1991).
- Thorstorn, R.K., Ramos, J., & Castillo, J.M. (1991). Breeding biology of the Collared Forest-falcon (*Micrastur semitorquatus*). Pp. 127-131 in: Whiteaker et al. (1991).
- Thorstorn, R.K., Turley, C.W., Ramirez, F.G., & Gilroy, B.A. (1990). Descriptions of nest, eggs and young of the Barred Forest-falcon (*Micrastur ruficollis*) and of the Collared Forest-falcon (*Micrastur semitorquatus*). *Condor* 90(2): 237-249.
- Thoulless, C.R., Fanshawe, J.H., & Bertram, B.C.R. (1989). Egyptian Vultures *Neophron percipiter* and Osprey *Struthio caroli* eggs: the origins of stone-throwing behaviour. *Ibis* 131(1): 9-15.
- Thorp, J.L. (1964). The cuckoos. Who they are, how they are kept and bred. *Avicult. Mag.* 70: 123-133.
- Thurber, W.A. & Serrano, J.R. (1972). Status of the White-tailed Kite in El Salvador. *Condor* 74(4): 489-491.
- Thurber, W.A., Serrano, J.F., Serrano, A., & Benítez, M. (1987). Status of uncommon and previously unreported birds of El Salvador. *Proc. West. Found. Vert. Zool.* 3: 109-293.
- Thurman, T.J., & Black, L.L. (1981). Ecology and behaviour of the Gynmogenes *Polystomus* species. *Oikos* 52: 25-35.
- Thurrow, T.L. & White, C.M. (1983). Nest site relationship between Ferruginous Hawk and Swainson's Hawk. *J. Field Orn.* 54: 401-406.
- Thurrow, T.L., White, C.M., Howard, R.P., & Sullivan, J.F. (1980). *Raptor Ecology of Raft River Valley*. Idaho E.G. & G. Idaho, Idaho Falls, USA.
- Tikader, B.K. (1988). *Birds of Andaman and Nicobar Islands*. Zool. Surv. India, Calcutta.
- Tiley, L.L. (1985). Notes on nesting Spotted Harriers *Circus assimilis*. *Aust. Bird Watcher* 11: 97.
- Tilman, L. (1986a). Geographical variation in the breeding success of the Golden Eagle *Haliaeetus*. *Ardea* 25: 195-200.
- Tilman, L. (1986b). Sperser als Roofvijand van Zangvogels. *Ardea* 34: 1-123.
- Tilman, L. (1949). Beobachtungen über die Arbeitsteilung des Turmfalken (*Falco tinnunculus*) während der Fortpflanzungszeit. *Ardea* 29: 63-98.
- Tisbechkin, A.K. & Ivanovskiy, V.V. (1992). Status and breeding performance of the Osprey in northern Byelorussia. *Ornis Fenn.* 69: 149-154.
- Titus, K. & Fuller, M.R. (1990). Recent trends in counts of migrant hawks from northeastern North America. *J. Wildl. Manage.* 54: 463-470.
- Titus, K. & Mosher, J.A. (1981). Nest-site habitat selection by woodland hawks in the central Appalachians. *Auk* 98: 270-281.
- Titus, K., Fuller, M.R., Stauffer, D.F., & Sauer, J.R. (1989). Buteos. Pp. 53-64 in: *Proc. N. Raptor Manage. Symp.*, and *Workshop*, 1989, National Wildlife Federation, Washington, D.C.
- Tjebknecht, M. (1984). Diet of the Golden Eagle *Haliaeetus* in a mountainous area in Sweden. *Ornis Fenn.* 4: 12-19.
- Tjernberg, M. (1983a). Prey abundance and reproductive success of the golden eagle *Aquila chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983b). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983c). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983d). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983e). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983f). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983g). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983h). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983i). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983j). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983k). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983l). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983m). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983n). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983o). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983p). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983q). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983r). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983s). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983t). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983u). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983v). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983w). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983x). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983y). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1983z). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 6: 17-23.
- Tjernberg, M. (1984a). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984b). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984c). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984d). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984e). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984f). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984g). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984h). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984i). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984j). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984k). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984l). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984m). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984n). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984o). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984p). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984q). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984r). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984s). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984t). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984u). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984v). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984w). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984x). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984y). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1984z). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 7: 1-10.
- Tjernberg, M. (1985a). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985b). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985c). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985d). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985e). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985f). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985g). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985h). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985i). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985j). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985k). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985l). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985m). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985n). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985o). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985p). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985q). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985r). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985s). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985t). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985u). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985v). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985w). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985x). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985y). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1985z). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 8: 1-10.
- Tjernberg, M. (1986a). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 9: 1-10.
- Tjernberg, M. (1986b). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 9: 1-10.
- Tjernberg, M. (1986c). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 9: 1-10.
- Tjernberg, M. (1986d). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 9: 1-10.
- Tjernberg, M. (1986e). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 9: 1-10.
- Tjernberg, M. (1986f). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.* 9: 1-10.
- Tjernberg, M. (1986g). *Haliaeetus chrysaetos* in Sweden. *Ornis Fenn.</*

- Todd, W.E.C. (1932). Critical notes on the Cracidae. *Proc. Biol. Soc. Washington* 45: 209-214.
- Todd, W.E.C. & Carricker, M.A. (1922). The birds of the Santa Marta region of Colombia: a study in altitudinal distribution. *Ann. Carnegie Mus.* 14.
- Todd, W.T., Plasse, R. & Eckart, C. (1992). Curassow husbandry: suggested protocol. Houston Zoological Gardens, TX.
- Tuepfer, J.E., Eng, R.L. & Anderson, R.K. (1990). Translocating prairie grouse: what have we learned? *Trans. North Amer. Wildl. Nat. Resour. Conf.* 55: 569-579.
- Tukunaga, H. (1987). Trade in curassows from Colombia. Unpublished memorandum to TRAFFIC (Japan).
- Toland, B. (1984). Unusual predatory and caching behavior of the American Kestrel in central Missouri. *J. Raptor Res.* 18: 107-110.
- Toland, B. (1985a). Food habits and hunting success of Cooper's Hawk in Missouri. *J. Field Orn.* 56: 419-422.
- Toland, B. (1985b). Double brooding by American Kestrels in central Missouri. *Condor* 87: 434-436.
- Tollan, A.M. (1988). Maintenance energy requirements and energy assimilation efficiency of the Australasian Harrier. *Ardea* 76: 181-186.
- Tombback, D.F. & Murphy, J.R. (1981). Food deprivation and temperature regulation in nesting Ferruginous Hawks. *Wilson Bull.* 93: 92-97.
- Tomek, W. (1965). [*Tetrastes bonasia* (L.) in Ciekowice Highlands, southern Poland]. *Przeł. zool.* 9: 395-404. In Polish.
- Tomlinson, R.E. (1972a). Review of literature on the endangered Masked Bobwhite. *US Fish and Wildlife Service, Res. Publ.* 10: 1-28.
- Tomlinson, R.E. (1972b). Current status of the endangered Masked Bobwhite Quail. *Trans. North Amer. Wildl. Nat. Resour. Conf.* 37: 294-311.
- Tomlinson, R.E. (1975). Weights and wing lengths of wild Sonoran Masked Bobwhites during fall and winter. *Wilson Bull.* 87: 180-186.
- Tomlinson, R.E. (1984). *Masked Bobwhite Recovery Plan*. US Fish and Wildlife Service, Albuquerque, New Mexico, USA.
- Tommeras, P.J. (1978). Kunstige reirplasser for juktalk *Falco rusticolus* og vanderfalk *Falco peregrinus*. *Var Fagel fauna* 1: 124-151.
- Tommeras, P.J. (1989). A time-lapse nest study of a pair of Gyrfalcons *Falco rusticolus* from their arrival at the nesting ledge to the completion of egg-laying. *Fauna Norvegica (Ser. C. Cinclus)* 12: 52-63.
- Toone, W. & Rissler, A.C. (1988). Captive management of the California Condor *Gymnogyps californianus*. *Int. Zoo. Yb.* 27: 50-58.
- Torres, B. (1989). La dieta del paji (Mitu mitu) o las vicisitudes de ser frugivoro. *Boletín de Lima* 66: 87-90.
- Torres Leyva, A., Wotzkow Alvarez, C. & Rams Becerra, A. (1988). Algunas consideraciones sobre la biología del Gavilán Colilargo Oriental *Accipiter gularis* wileyi (Wotzkow) en las provincias orientales. *Gaceta* 10: 1-2.
- Tostain, O. (1986a). Adaption du mode de chasse chez le Faucon des chauves-souris (*Falco ruficularis*) en Guyane. *Alauda* 54(1): 66-67.
- Tostain, O. (1986b). Etude d'une succession terrestre en milieu tropical: les relations entre la physiologie végétale et la structure du peuplement avien en mangrove guyanaise. *Rev. Ecol. (Terre Vie)* 41(4): 315-342.
- Tostain, O., Djardain, J.L., Éraud, C. & Thiollay, J.M. (1992). *Oiseaux de Guyane*. Société d'Etudes Ornithologiques, Paris.
- Towers, J. (1988). Age determination of juvenile Spruce Grouse in eastern Canada. *J. Wildl. Manage.* 52: 113-115.
- Towers, S.R. (1990). Cuckoldry in an American Kestrel triad. *Condor* 92: 257-258.
- Trull, P.W. (1987). Predation and antipredator behavior at Guianan Cock-of-the-rock leks. *Auk* 104(3): 496-507.
- Trautman, C.G. (1982). *History, Ecology and Management of the Ring-necked Pheasant in South Dakota*. South Dakota Department of Game, Fish & Parks.
- Traylor, M.A. (1941). Birds from the Yucatán Peninsula. *Field Mus. Nat. Hist. Zool. Ser.* 24: 195-225.
- Traylor, M.A. (1948). New birds from Peru and Ecuador. *Fieldiana, Zool.* 31: 195-200.
- Traylor, M.A. (1958). *Birds of Northwestern Peru*. Chicago Natural History Museum.
- Traylor, M.A. (1960a). Notes on the birds of Angola, non-passers. *Publ. Cult. Camp. Diam. Angola, Lisbon* 51: 129-186.
- Traylor, M.A. (1960b). *Francolinus schlegelii* Meuglin in Cameroon. *Bull. Brit. Orn. Club* 80: 86-88.
- Traylor, M.A. (1963). *Check-list of Angolan birds*. Comp. Diam. Angola, Museo do Dundo, Lisbon.
- Tree, A.J. (1973). Honey Buzzard *Pernis ptilorhynchus*. *Ostrich* 44: 127.
- Tree, A.J. (1978). Whether the Bateleur? *Honeyguide* 95: 37-38.
- Treus, V.D. & Streichenko, V.I. (1970). [Breeding of the Steppe Eagle (*Aquila rapax nipalensis*) at the Askaniya-Nova Reserve, Russia]. *Nature (Nauka)* 12. In Russian.
- Tribarres, J.F. (1975). Biología del Águila calzada (*Hieraaetus pennatus*) durante el período de nidificación en Navarra. *Ardeola* 21: 305-320.
- Troppe, J. (1966). Some observations on the Harlequin Quail (*Centurus delegorguei*). *Avicult. Mag.* 72: 5-6.
- Troy, S. & Elgar, M.A. (1991). Brush-turkey incubation mounds: mate attraction in a promiscuous mating system. *Trends in Ecol. & Evol. (Tree)* 6(7): 202-203.
- Tubbs, C.R. (1974). *The Buzzard*. David & Charles, Newton Abbott, UK.
- Tucker, V.A. & Heine, C. (1990). Aerodynamics of gliding flight in a Harris' Hawk, *Parabuteo unicinctus*. *J. Exper. Biol.* 149: 469-490.
- Tuer, F.V. (1973). Notes on the African Hawk-eagle and Wahlberg's Eagle in the Matopos. *Honeyguide* 75: 19-21.
- Tuer, V. & Tuer, J. (1974). Crowned Eagles of the Matopos. *Honeyguide* 80: 32-39.
- Turner, D.A. (1977). Status and distribution of East African endemic species. *Scopus* 1: 2-11.
- Tyagunov, A.S. (1984). [Patterns of historical changes in the range of the Black Grouse in the Ukraine]. [All-Union Zoogeograph. Conf. Moscow], 8: 148-149. In Russian.
- Tymstra, Y.R. (1993). Some bird observations from the lower Apsuwa River, east Nepal. *Forktail* 8: 53-64.
- Tyurekhodzhev, Zh.M. (1973). [Influence of the Steppe Eagle on the population structure and numbers of the Little Sushik]. *Proc. Kazan Sci. Research Inst. of Plant Protection* 12: 69-76. In Russian.
- Tyurekhodzhev, Zh.M. (1977). [The Steppe Eagle and Lanner Falcon in the Ural Region]. Pp. 240-243 in: [Rare and Endangered Animals and Birds of Kazakhstan]. Alma-Ata. In Russian.
- Ueoka, M.L. & Koplin, J.R. (1973). Foraging behavior of Ospreys in northwestern California. *J. Raptor Res.* 7(2): 32-38.
- Ueta, M. (1992a). [The number of small birds taken by breeding Japanese Lesser Sparrowhawks *Accipiter gularis* in suburban areas, Tokyo]. *Strix* 11: 131-136. In Japanese with English summary.
- Ueta, M. (1992b). [Comparison of the prey abundance for Japanese Lesser Sparrowhawks *Accipiter gularis* in suburban and mountainous areas]. *Strix* 11: 137-141. In Japanese with English summary.
- Ueta, M. (1993). [Seasonal change of prey items of Japanese Lesser Sparrowhawks *Accipiter gularis* during the breeding period]. *Strix* 12: 81-84. In Japanese with English summary.
- Ueta, M. (1994). Azure-winged Magpies, *Cyanopica cyana*, "parasitize" nest defence provided by Japanese Lesser Sparrowhawks. *J. Zool. Zool.* 1: 1-11. In Japanese with English summary.
- Uhlig, R. (1994). Zur Verbreitung des Schreiadlers *Aquila pomarina* in Rumänien. In: Meyburg & Chancellor (1994b).
- U'Janin, N.S. (1949). [On the ecology of the Black Grouse, the Willow Grouse and the Grey Partridge in northern Kazakhstan]. *Trudy Nauchn. gos. zapovednika* 11: 108-139.
- U'Janin, N.S. & Steen, J.B. (1985). Behaviour and social structure in Svalbard Rock Ptarmigan *Lagopus mutus hyperboreus*. *Ornis Scand.* 16: 198-204.
- U'Janin, N.S., Mortensen, A. & Elvén, A. (1985). Seasonal changes in crop content of the Svalbard ptarmigan *Lagopus mutus hyperboreus*. *Polar Research* 3: 193-245.
- Underhill-Day, J.C. (1984). Population and breeding biology of Marsh Harriers in Britain since 1900. *J. Appl. Ecol.* 21: 773-787.
- Underhill-Day, J.C. (1993). The foods and feeding rates of Montagu's Harriers *Circus pygargus* breeding in arable farmland. *Bird Study* 40(1): 74-80.
- Urban, E.K. (1959). *Indagatio Canadensis*. Mexico: University of Kansas Publications, Museum of Natural History (110). University of Kansas, Lawrence.
- Urban, E.K. (1980). *Ethiopia's Endemic Birds*. Ethiopian Tourism Commission, Addis Ababa, Ethiopia.
- Urban, E.K., Fry, C.H. & Keith, S. (1986). *The Birds of Africa*. Vol II. Academic Press, London & New York.
- Uribe, D.A. (1986). *Contribución al conocimiento de la Aves del Bosque muy Húmedo Montano Bajo en Cerro de Manzales*. MSc thesis, Universidad de Cádiz, Manzales, Colombia.
- Uribe, V. (1986). *Requerimientos Ecológicos y Relaciones Interspecificas del Águila Real Aquila chrysaetos homeyeri Severin, 1888 y del Águila Peregrina Hieraaetus fasciatus fasciatus Vieillot, 1822 (Accipitriformes, Accipitridae) en la provincia de Valencia, PhD thesis, Universidad de Valencia, Spain.*
- Ushakov, S.L. (1949). [The Imperial Eagle - *Aquila heliaca heliaca* Savigny in the Ilimen Nature Reserve]. *Trudy Ilimsk. zapovednika* 4: 182-201. In Russian.
- U'tung, J.C. (1993). Avifaunal survey of forest reserves in Mahadayi Valley, Western Ghats, India. *Bull. Oriental Bird Club* 18: 11.
- Uttendörfer, O. (1952). *Neue Ergebnisse über die Ernährung der Greifvögel und Eiden*. Eugen Ulmer, Stuttgart.
- Uusvaara, O. (1963). The structure of the habitat of the Hazel Grouse. *Suomen Riista* 16: 31-45.
- Valanne, K. (1966). Incubation behaviour and temperature of Capercaillie (*Tetrao urogallus*) and Willow Grouse (*Lagopus lagopus*). *Suomen Riista* 19: 30-41.
- Valverde, J.A. (1957). *Aves del Sahara Español*. Madrid.
- Valverde, J.A. (1960). La población d'Águilas imperiales (*Aquila heliaca adalberti*) des Marins du Guadalquivir: son évolution depuis un siècle. *Alauda* 28: 20-26.
- Valverde, J.A. (1966). Sobre Buitres Negros en Andalucía. *Ardeola* 12: 101-115.
- Valverde, J.A. & Bernis, F. (1960). Sur l'écologie de *Gyps fulvus* en Espagne. Pp. 737-746 in: *Proc. XII Int. Orn. Congr.* Helsinki 1958.
- Van de Weghe, J.P. (1978). Les rapaces paléarctiques au Rwanda. *Gerfaut* 68: 493-519.
- Van Tyne, J. (1935). *The Birds of Northern Petén, Guatemala*. Museum of Zoology Miscellaneous Publications 27. University of Michigan Press, Ann Arbor, Michigan, USA.
- Van Tyne, J. & Trautman, M.B. (1941). New birds from the Yucatán. *Univ. Mich. Mus. Zool. Occ. Pap.* 439.
- Vance, D.R. & Westemeier, R.L. (1979). Interactions of pheasants and prairie chickens in Illinois. *Wildl. Soc. Bull.* 7: 221-225.
- Vander Haegen, W.M., Dodge, W.E. & Sayre, M.W. (1989a). Factors affecting productivity in a northern Wild Turkey population. *J. Wildl. Manage.* 52(1): 127-133.
- Vander Haegen, W.M., Sayre, M.W. & Dodge, W.E. (1989b). Winter use of agricultural habitats by Wild Turkeys in Massachusetts. *J. Wildl. Manage.* 53(1): 30-35.
- Vanderschagen, P.V. (1970). *Food habits of Ruffed Grouse at the Cloquet Forest Research Center, Minnesota*. MSc thesis, University of Minnesota, Minneapolis.
- Vangilder, L.D., Kurzeleski, E.Z., Kimmel-Truit, V.L. & Lewis, J.B. (1987). Reproductive parameters of Wild Turkey hens in north Missouri. *J. Wildl. Manage.* 51(3): 535-540.
- Vannini, J.P. (1989). Neotropical raptors and deforestation: notes on diurnal raptors at Finca el Faro, Quetzaltenango, Guatemala. *J. Raptor Res.* 23(2): 27-38.
- Vannini, J.P. & Rockstroh, P.M. (1988). The status of cracids in Guatemala. Unpublished report presented at the II International Cracid Symposium, Caracas, Venezuela, February/March 1988.
- Varland, D.E. (1991). *Behavior and Ecology of Post-fledging American Kestrels*. PhD thesis, Iowa State University, Ames, Iowa.
- Varland, D.E. & Loughin, T.M. (1993). Reproductive success of American Kestrels nesting along an interstate highway in central Iowa. *Wilson Bull.* 105: 465-474.
- Varland, D.E., Kians, E.E. & Loughin, T.M. (1993). Use of habitat and perches, causes of mortality and time until dispersal in post-fledging American Kestrels. *J. Field Orn.* 64: 169-178.
- Varshavsky, B.S. (1973). [Some landscape-ecological features in the feeding of the Long-legged Buzzard, Imperial Eagle and Steppe Eagle in the north Aral region]. *Byull. Mosk. Obsch. Ispyt. Priro. old. Geol.* 78: 30-37. In Russian.
- Varshavsky, B.S. (1983). [Some landscape-ecological peculiarities in the nutrition of the Long-legged Buzzard, and Imperial and Steppe Eagles in the north Aral Lake area]. *Byull. Mosk. Obsch. Ispyt. Priro. old. biol.* 78. In Russian.
- Varshavsky, B.S., Varshavsky, S.N., Garbuzov, V.K., Shilov, M.N. & Shutov, P.N. (1980). [Some peculiarities of the feeding ecology of the Steppe Eagle in Mugodzhary and adjoining areas]. In: *Materials of the 3rd All-union Meeting "Species and their productivity within their breeding range"*. Palanga, Vilnius. In Russian.
- Varshavsky, S.N., Shilov, M.N., Varshavsky, B.S., Garbuzov, V.K., Kamnev, P.I., Shutov, P.N. & Rfanov, B.N. (1980). [Zonal-geographical peculiarities of the feeding of the Steppe Eagle in the western part of its breeding range in connection with its feeding specialization]. [All-Union Zoogeograph. Conf., Moscow], 7: 104-107. In Russian.
- Vasic, V., Grubac, R.B. & Susic, G. (1985). The status of birds of prey in Yugoslavia, with particular reference to Macedonia. Pp. 45-53 in: Newton & Chancellor (1985).
- Vasina, W.G. & Straneck, R.J. (1988). Biological and ethological notes on *Falco peregrinus cassini* in central Argentina. *J. Raptor Res.* 18: 123-130.
- Vasvári, M. (1935). Das einstige Brüten des Mönchseigers im Siebenbürgischen Erzgebirge. *Aquila* 38-39: 361, 25.
- Vasvári, N. (1939). Die Verbreitung und Ökologie des Kaiseradlers (*Aquila heliaca* Savigny). *Festschrift* 60. *Gebirgsforsch. Prof. E. Strindberg (Riga)* 5: 290-317.
- Vaucher, C. (1971). Notes sur l'écologie de l'aigle de Bonelli. *Nox Oiseaux* 338-339: 101-111.
- Vaughan, C. (1990). Patterns in natural resource destruction and conservation in Central America: a case for optimism? *Trans. North Amer. Wildl. Nat. Resour. Conf.* 55: 409-422.
- Vaughan, R. (1961). *Falco eleonorae*. *Ibis* 103: 114-128.
- Vaurie, C. (1961a). Systematic notes on Palearctic birds. No. 45. Falconidae: The genus *Falco* (Part 2). *Amer. Mus. Novit.* 2038.
- Vaurie, C. (1961b). Systematic notes on Palearctic birds. No. 44. Falconidae: the genus *Falco* (Part 1, *Falco peregrinus* and *Falco peregrinoides*). *Amer. Mus. Novit.* 2035.
- Vaurie, C. (1962). A systematic study of the Red-backed Hawks of South America. *Condor* 64: 277-290.
- Vaurie, C. (1964). Systematic notes on the bird family Cracidae. No. 1. Geographical variation of *Oriolus canicollis* and *Penelope marail*. *Amer. Mus. Novit.* 2197: 1-8.
- Vaurie, C. (1965a). Systematic notes on the bird family Cracidae. No. 2. Relationships and geographical variation of *Oriolus canicollis*, *Oriolus poliocephalus*, and *Oriolus leucogastra*. *Amer. Mus. Novit.* 2222: 1-36.
- Vaurie, C. (1965b). Systematic notes on the bird family Cracidae. No. 3. *Oriolus guttata*, *Oriolus superciliosus*, and *Oriolus monomi*. *Amer. Mus. Novit.* 2232: 1-21.
- Vaurie, C. (1965c). Systematic notes on the bird family Cracidae. No. 4. *Oriolus garraula* and *Oriolus ruficauda*. *Amer. Mus. Novit.* 2237: 1-16.
- Vaurie, C. (1965d). *The Birds of the Palearctic Fauna. Non-Passeriformes*. H.F. & G. Witherby, London.
- Vaurie, C. (1966a). Systematic notes on the bird family Cracidae. No. 5. *Penelope purpurascens*, *Penelope jacquacu* and *Penelope obscura*. *Amer. Mus. Novit.* 2250: 1-23.
- Vaurie, C. (1966b). Systematic notes on the bird family Cracidae. No. 6. Reviews of nine species of *Penelope*. *Amer. Mus. Novit.* 2251: 1-30.
- Vaurie, C. (1967a). Systematic notes on the bird family Cracidae. No. 7. The genus *Pipile*. *Amer. Mus. Novit.* 2296: 1-16.
- Vaurie, C. (1967b). Systematic notes on the bird family Cracidae. No. 8. The genera *Aburria*, *Chamaepetes*, and *Penelopina*. *Amer. Mus. Novit.* 2299: 1-12.
- Vaurie, C. (1967c). Systematic notes on the bird family Cracidae. No. 9. The genus *Crax*. *Amer. Mus. Novit.* 2305: 1-20.
- Vaurie, C. (1967d). Systematic notes on the bird family Cracidae. No. 10. The genera *Mitu* and *Parus* and generic relationships of Cracini. *Amer. Mus. Novit.* 2307: 1-20.
- Vaurie, C. (1968). Taxonomy of the Cracidae (Aves). *Bull. Amer. Mus. Nat. Hist.* 138(4): 131-260.
- Vaurie, C. (1972). *Tibet and Its Birds*. Witherby, London.
- Vehlen, T.T. (1976). The urgent need for forest conservation in highland Guatemala. *Biol. Conserv.* 9: 141-154.
- Vermaan, P.A. (1991). The monthly pattern of records of the Australian Hobby *Falco longipennis* in Canberra. *A.C.T. Austr. Bird Watcher* 14: 70-72.
- Veghte, J.H. & Herreid, C.F. (1965). Radiometric determination of feather insulation and metabolism of Arctic birds. *Physiol. Zool.* 38: 267-275.
- Vehrencamp, S.L., Bradbury, J.W. & Gibson, R.M. (1989). The energetic costs of display in male Sage Grouse. *Anim. Behav.* 38: 885-896.
- Veiga, J.P. & Hirafudo, F. (1990). Food habits and the survival and growth of nestlings in two sympatric kites (*Milvus milvus* and *Milvus migrans*). *Holarctic Ecol.* 13(1): 62-71.
- Veiga, J.P., Alonso, J.C. & Alonso, J.A. (1984). Sobre la población de Águilas Imperiales (*Aquila heliaca adalberti*) de la Sierra de Guadarrama. Pp. 54-59 in: CRPR (1984). *Rapinyeres Mediterranis II*. Centre de Recerca i Protecció de Rapinyeres, Barcelona, Spain.
- Venegas, C. & Jory, J. (1979). *Gula de Campa para las Aves de Magallanes*. Inst. Patagonia, Punta Arenas.
- Verheugt, W.J.M., Skov, H. & Danielsen, F. (1993). Notes on the birds of the tidal lowlands and floodplains of South Sumatra Province, Indonesia. *Kukila* 6(2): 53-84.
- Verheyen, R. (1953). Exploration du Parc National de l'Upemba. (Mission G. F. de Witte). *Oiseaux* 19: 1-687.
- Verheyen, R. (1956). Contribution à l'anatomie et à la systématique des Galliformes. *Bull. Inst. Roy. Sci. Nat. Belgique* 32(42): 1-24.
- Verheyen, W.N. (1962a). The Congo Peacock *Afrapavo congensis* Chapin 1936 at Antwerp Zoo. *Int. Zool. Yb.* 4: 87-91.
- Verheyen, W.N. (1962b). Monographie du Paon congolais *Afrapavo congensis* Chapin 1936. *Bull. Soc. Royal Zool. Anvers* 26: 1-98.
- Verheyen, W.N. (1965a). *Der Kongopauz (Afrapavo congensis Chapin, 1936)*. Die Neue Brehm Bucherei Heft 351. A. Ziemsen, Wittenberg Lutherstadt.
- Verheyen, W.N. (1965b). Breeding the Congo Peacock at Antwerp Zoo. *Int. Zool. Yb.* 5: 127-128.

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- Watson, J., Leitch, A.F. & Rae, S.R. (1993). The diet of Golden Eagles *Aquila chrysaetos* in Scotland. *Ibis* 135(4): 387-393.
- Watson, J., Rae, S.R. & Stillman, R. (1992). Nesting density and breeding success of the Golden Eagle *Aquila chrysaetos* in relation to food supply in Scotland. *J. Anim. Ecol.* 61: 543-550.
- Watson, J.W. (1984). *Rough-legged Hawk Winter Ecology in Southeastern Idaho*. MS thesis, Montana State University, Bozeman.
- Watson, R.T. (1985). Range reduction of the Bateleur *Terathopius ecaudatus* and the development of agriculture in South Africa. Page 178 in: *Proc. Birds & Man Symp.* Witwatersrand Bird Club, Johannesburg.
- Watson, R.T. (1987). Flight identification of Bateleur age classes: a conservation incentive. *Bukalandiye* 39: 37-39.
- Watson, R.T. (1988). The influence of nestling predation on nest site selection and behaviour of the Bateleur. *S. Afr. J. Zool.* 23: 143-149.
- Watson, R.T. (1989). Aggressive display and territoriality of the Bateleur *Terathopius ecaudatus*. *S. Afr. J. Zool.* 24: 146-150.
- Watson, R.T. (1990a). Population dynamics of the Bateleur in the Kruger National Park. *Ostrich* 61: 5-12.
- Watson, R.T. (1990b). Breeding biology of the Bateleur. *Ostrich* 61: 13-23.
- Watson, R.T., Berkelman, J., Lewis, R. & Kafzafindramuana, S. (1993). Conservation studies on the Madagascar Fish Eagle *Haliastur vociferans*. Pp. 192-196 in: Wilson (1993).
- Watt, P.G. (1969). *Mobility Patterns, Habitat Relationships and Reproductive Success of Greater Prairie Chickens* (*Tympanuchus cupido pinnatus*) in Northeastern Kansas. MSc thesis, Kansas State University, Manhattan.
- Wattel, J. (1973). *Geographical Differentiation in the Genus Ascalaph*. Publications of the Nuttall Ornithological Club 13 Cambridge, Massachusetts.
- Watts, C.R. & Stokes, A.W. (1971). The social order of turkeys. *Scientific American* 224(6): 112-118.
- Wauer, R.H. & Russell, R.C. (1967). New additional records of birds in the Virgin River Valley. *Condor* 69: 420-422.
- Wayne, P. (1964). Display of the Common Koklass (*Pucrasia m. macrolopha* Lesson). Page 13 in: 1964 Report, Ornamental Pheasant Trust.
- Wayne, P. (1969). A Guide to the Pheasants of the World. Country Life, London.
- Weatherly, R., Baker-Gabb, D.J. & Mooney, N.J. (1985). Juvenile plumage and plumage variation in the Brown Falcon *Falco berigora*. *Emu* 85: 257-260.
- Weathers, W.W., Seymour, R.S. & Baudinette, R.V. (1993). Energetics of mound-tending behaviour in the Malleefowl, *Leipoa ocellata* (Megapodiidae). *Anim. Behav.* 45: 333-341.
- Weathers, W.W., Weathers, D.L. & Seymour, R.S. (1990). Polygyny and reproductive effort in the Malleefowl *Leipoa ocellata*. *Emu* 90: 1-6.
- Weaver, J.K. & Moshy, H.S. (1979). Influence of hunting regulations on Virginia Wild Turkey populations. *J. Wildl. Manage.* 43(1): 128-135.
- Weaving, A.J.S. (1972). Augur Buzzards. Observations at a nest. *Honeyguide* 70: 19-20.
- Weaving, A.J.S. (1977). Observations on a pair of Cuckoo Falcons. *Honeyguide* 80: 28-31.
- Webb, H.P. (1962). Field observations of the birds of Santa Isabel, Solomon Islands. *Emu* 92: 52-57.
- Weber, D.A. (1975). *Blue Grouse Ecology: Habitat Requirements and Response to Habitat Manipulation in North Central Utah*. Special Report 33, Utah Coop. Wildlife Research Unit.
- Weeden, R.B. (1963). Management of ptarmigan in North America. *J. Wildl. Manage.* 27: 673-683.
- Weeden, R.B. (1964). Spatial separation of sexes in Rock and Willow Ptarmigan in winter. *Auk* 81: 534-541.
- Weeden, R.B. (1965). Breeding density, reproductive success, and mortality of Rock Ptarmigan at Eagle Creek, Alaska, from 1960-1964. *Trans. North Amer. Wildl. Nat. Resour. Conf.* 30: 336-348.
- Weeden, R.B. (1966). Molts of primaries of adult Rock Ptarmigan in Central Alaska. *Auk* 83: 587-597.
- Weeden, R.B. (1967). Seasonal and geographic variation in the foods of adult White-tailed Ptarmigan. *Condor* 69: 303-309.
- Weeden, R.B. (1969). Foods of Rock and Willow Ptarmigan in central Alaska with comments on interspecific competition. *Auk* 86: 271-281.
- Weeden, R.B. (1972). Effects of hunting on Rock Ptarmigan along Steese Highway. *Wildl. Bull.* 2. Alaska Department of Fish and Game.
- Weeden, R.B. (1979). Relative heart size in Alaskan Tetraonidae. *Auk* 96: 306-318.
- Weeden, R.B. & Theberge, J.B. (1972). The dynamics of a fluctuating population of Rock Ptarmigan in Alaska. Pp. 90-106 in: *Proc. XV Int. Orn. Congr., the Hague, 1970*.
- Weeden, R.B. & Watson, A. (1967). Determining the age of Rock Ptarmigan in Alaska and Scotland. *J. Wildl. Manage.* 31: 825-826.
- Wegge, P. (1980). Distorted sex ratio among small broods in a declining Capercaillie population. *Ornis Scand.* 11: 106-109.
- Wegge, P. (1985). Spacing patterns and habitat use of Capercaillie hens in spring. Pp. 261-277 in: Lovel & Hudson (1985).
- Wegge, P. & Larsen, P.B. (1987). Spacing of adult and subadult male Common Capercaillie during the breeding season. *Auk* 104: 481-490.
- Wegge, P. & Storaas, T. (1990). Nest loss in Capercaillie and Black Grouse in relation to small rodent cycles in southeast Norway. *Oecologia* 82: 527-530.
- Wegge, P., Gjerd, L., Kastedalen, L., Larsen, B.B., Rolstad, J. & Storaas, T. (1988). Natural mortality and predation of adult Capercaillie in southeast Norway. Pp. 49-56 in: Lovel & Hudson (1988).
- Wegner, P. (1994). Population ecology of Peregrine Falcons *Falco peregrinus* in Baden Württemberg. 1965-1991. In: Meyburg & Chancellor (1994a).
- Weick, F. (1980). *Birds of Prey of the World*. Collins, London.
- Weick, F. (1989). *Zur Taxonomie des Wanderfalken Falco peregrinus Tunstall 1771*. Beihefte zu Ökologie der Vögel 1. Ludwigsgrey, Germany (privately published).
- Weigelt, C. & Schulz, H. (1992). Counts of Lappet-faced Vultures *Torgus tracheliotus* at Mahazat As Said (Saudi Arabia), with a discussion of the species' taxonomy. *Sandgrasse* 14: 16-26.
- Weir, D. & Picot, N. (1975). Aspects of social behaviour in the Buzzard. *British Birds* 68: 125-141.
- Weir, D.G. (1973). Social and habits of *Megapodius ptilinopus*. *Wilson Bull.* 85: 79-82.
- Welse, I.H. & Basson, N.C.J. (1967). The oral toxicity of dieldrin to the Crowned Guineafowl *Nunidia meleagris* (L.). *S. Afr. J. Agric. Sci.* 10: 697-706.
- Welch, B.L., Pederson, J.C. & Rodriguez, R.L. (1988). Selection of big sagebrush by Sage Grouse. *Great Basin Nat.* 48: 274-279.
- Welch, G. & Welch, H. (1985). Observations on the endemic Djibouti Francolin *Francolinus ocellatus* with emphasis on potential threats to the population. *J. World Pheasant Assoc.* 10: 65-71.
- Welch, G. & Welch, H. (1988). The autumn migration of raptors and other soaring birds across the Bab-el-Mandeb Straits. *Sandgrasse* 10: 26-50.
- Welch, G., Welch, H., Denton, M. & Cogilan, S. (1986). Djibouti II preliminary report. *World Pheasant Assoc. News* 12: 24-27.
- Welch, H. & Welch, G. (1984). Brief summary of findings of the Djibouti Expedition - March 1984. Unpublished.
- Welch, D.R. (1965). Grey Kestrel eating oil-palm nut fibre. *Bull. Nigerian Orn. Soc.* 2: 110.
- Welch, D.R. (1985). The forest avifauna of Western Malaysia and its conservation. Pp. 213-232 in: Diamond & Lovejoy (1985).
- Welch, D.R. (1990). Malayan bird reports 1982-1987. *Mulas, Nat. J.* 116-210.
- Wen Xian-ji & Yang Lan (1990). Comparative studies of the skeletal systems of *Phasianus colchicus* and *Chrysolophus* species. Pp. 90-91 in: Hill et al. (1990).
- Wendell, G.S. (1977). Food of three upland game birds in Selenger Area, Kajiado District, Kenya. *East Afr. Wildl. J.* 15: 99-105.
- Wendland, V. (1932). Zur Biologie des Schneeadlers (*Aquila pomarina*). *Beitr. Forstplanungsbild.* Vogel 8: 1-9, 47-53.
- Wendland, V. (1951). Zwanzigjährige Beobachtungen über den Schneeadler *Aquila pomarina*. *Vogelwelt* 72: 4-11.
- Wendland, V. (1958). Der Schneeadler. *Falke* 5: 6-13.
- Wendland, V. (1959). *Schneeadler und Schelladler*. A. Ziemsen-Verlag, Wittenberg-Luthardt.
- Wendt, A.M. & Septon, G.A. (1991). Notes on a successful nesting by a pair of yearling Peregrine Falcons *Falco peregrinus*. *J. Raptor Res.* 25: 21-22.
- Wenrich, G. (1981). Hornbokko (*Panius unicoloris*) im Vogelpark Waldröde. *Gefiederte Welt* 105: 121-123.
- Wenrich, G. (1984). First captive breeding of the Secretary Bird *Sagittarius serpentarius* at the Waldröde Bird Park. *Int. Zool. Yb.* 23: 64-66.
- Wenny, D. (1993). Black Gulls and seed dispersal in Costa Rica. *Condor* 95: 2(1): 13-14.
- Weston, W.D., Vanderschueren & Gullim, G.W. (1972). Ruffed Grouse primary mitre chromosome. *Auk* 89: 671-673.
- Weske, J.S. & Terborgh, J. (1971). A new subspecies of curassow of the genus *Pauxi* from Peru. *Auk* 88(2): 233-238.
- West, G.C. (1968). Bioenergetics of captive Willow Ptarmigan under natural conditions. *Ecology* 49: 1035-1045.
- West, G.C. (1972). Seasonal differences in resting metabolic rate of Alaskan Ptarmigan. *Comp. Biochem. Physiol.* 42A: 867-876.
- West, G.C. & Meng, M.S. (1966). Nutrition of Willow Ptarmigan in northern Alaska. *Auk* 83: 603-615.
- West, G.C. & Meng, M.S. (1968). Seasonal changes in body weight and fat and relation of fatty acid composition to diet in the Willow Ptarmigan. *Wilson Bull.* 80: 426-441.
- West, J., Madinah & Malik Hasan (1981). Artificial incubation of the Moluccan Scrub Hen *Eulipia wallacei*. *Int. Zool. Yb.* 21: 115-118.
- West, S. (1975). Gray Hawk feeding on worm lizard. *Condor* 77(3): 354.
- Westall, M.A. (1984). *Proceedings of the Southeastern US and Caribbean Osprey Symposium*. TIOF, Sanibel, Florida.
- Westemeier, R.L. (1973). Prescribed burning in grassland management for prairie-chickens in Illinois. Pp. 317-338 in: *Proc. 12th Tall Timbers Fire Ecol. Conf.*
- Westemeier, R.L. (1980). Greater Prairie-chicken status and management. Pp. 18-28 in: Vohs & Knopf (1980).
- Westerskov, K. (1943). *Urfuglen*. Copenhagen.
- Westerskov, K. (1956). Age determination and dating nesting events in the Willow Ptarmigan. *J. Wildl. Manage.* 20: 274-279.
- Westerskov, K. (1985). Brown Quail *Synopsis ypsilophorus*. Page 158 in: Robertson (1985).
- Weston, J.B. (1969). Nesting ecology of the Ferruginous Hawk *Buteo regalis*. *Brigham Young Univ. Sci. Bull. (Biol. Ser.)* 10: 25-36.
- Wetmore, A. (1926). *Observations on the Birds of Argentina, Paraguay, Uruguay and Chile*. US National Museum Bulletin 133.
- Wetmore, A. (1927). *Scientific Survey of Puerto Rico and the Virgin Islands*. Vol. IX, Part 3. New York Academy of Sciences, New York.
- Wetmore, A. (1941). Notes on the birds of the Guatemala Highlands. *Proc. US Natl. Mus.* 89: 523-581.
- Wetmore, A. (1943). [On habits of Veracruz birds]. *Proc. US Natl. Mus.* 93: 243-246.
- Wetmore, A. (1944). (Taxonomy of *Herpethophilus cichinians*) *Proc. US Natl. Mus.* 95(3179): 35-39.
- Wetmore, A. (1963). Systematic notes concerned with the avifauna of Panama. *Smith. Misc. Coll.* 145: 1-14.
- Wetmore, A. (1964). A revision of the American Vultures of the genus *Cathartes*. *Smith. Misc. Coll.* 146: 1-48.
- Wetmore, A. (1965). *The Birds of the Republic of Panamá*, Part 1. Tinamidae (Tinamidae) to Rynchopidae (Skimmers). *Smith. Misc. Coll.* 150.
- Wetmore, A. (1974). The egg of a Collared Forest-falcon. *Condor* 76: 103.
- Wetmore, A. & Phelps, W.H. (1943). Description of a third form of curassow of the genus *Pauxi*. *J. Washington Acad. Sci.* 33: 142-146.
- Weyer, D. (1982). The bird that sounds like a jaguar. *AFA Watchbird* 9(4): 18-21.
- Whaley, W.H. (1979). *The Ecology and Status of the Harris' Hawk (Parabuteo unicinctus) in Arizona*. MSc thesis, University of Arizona.
- Whaley, W.H. (1986). Population ecology of the Harris' Hawk in Arizona. *J. Raptor Res.* 1: 1-15.
- Whaley, W.H. (1988). *Trends in Geographic Variation of Cooper's Hawk and Northern Goshawk: a Multivariate Analysis*. PhD thesis, Brigham Young University, Provo, Utah.
- Whaley, W.H. & White, C.M. (1994). Trends in geographic variation of Cooper's Hawk and Northern Goshawk in North America: a multivariate analysis. *Proc. West. Found. Wild. Zool.* 5(3).
- Whalley, H.E., Lisano, M.E. & Kenamer, J.E. (1977). Plasma corticosterone level as an indicator of stress in the Eastern Wild Turkey. *J. Wildl. Manage.* 41(2): 189-193.
- Wheeler, A.H. (1992). Reproductive parameters for free ranging American Kestrels (*Falco sparverius*) using nest boxes in Montana and Wyoming. *J. Raptor Res.* 26: 6-9.
- Wheelwright, N.T., Haber, W.A., Murray, K.G. & Guindon, C. (1984). Tropical fruit-eating birds and their food plants: a survey of a Costa Rican lower montane forest. *Biotropica* 16(3): 173-192.
- Whelan, D. (1992). Black Falcon robs Little Eagle. *Aust. Bird Watcher* 14: 192.
- Whitacre, D.F. & Jenny, J.P. (1991). Orange-breasted Falcon survey work in Guatemala and Belize, 1991 (*Falco diroreutes*). Pp. 137-143 in: Whitacre et al. (1991).
- Whitacre, D.F. & Thorstrom R.K. (1992). *Maya Project: Use of Raptors and Other Fauna as Environmental Indicators for Design, Management, and Monitoring of Protected Areas and for Building Local Capacity for Conservation in Latin America*. Progress Report V. The Peregrine Fund Inc., Boise, Idaho.
- Whitacre, D.F., Burnham, W.A. & Jenny, J.P. eds. (1991). *Maya Project: Use of Raptors and Other Fauna as Environmental Indicators for Design and Management of Protected Areas and Building Local Capacity for Conservation in Latin America*. Progress Report IV. 1991. The Peregrine Fund Inc., Boise, Idaho.
- White, C.M. (1975). Studies on Peregrine Falcons in the Aleutian Islands. *Raptor Res. Rep.* 3: 33-50.
- White, C.M. (1994). Population trends and current status of selected western raptors. *Studies Avian Biol.* 15: 310-330.
- White, C.M. & Boyce, D.A. (1987). Notes on the Mountain Caracara (*Phalacrocorax maculatus*) in the Argentine Puna. *Wilson Bull.* 99(2): 283-284.
- White, C.M. & Cade, T.J. (1971). Cliff-nesting raptors and Ravens along the Colville River in Arctic Alaska. *Living Bird* 10: 107-150.
- White, C.M. & Nelson, R.W. (1991). Hunting range and strategies in a tundra breeding Peregrine and Gyrfalcon observed from a helicopter. *J. Raptor Res.* 23: 49-62.
- White, C.M. & Thurow, T.L. (1985). Reproduction of Ferruginous Hawks exposed to controlled disturbance. *Condor* 87: 14-22.
- White, C.M. & Weeden, R.B. (1966). Hunting methods of Gyrfalcons and behavior of their prey (ptarmigan). *Condor* 68: 517-519.
- White, C.M., Boyce, D.A. & Stranek, R. (1989). Observations on *Buteo swainsoni* in Argentina in 1984, with comments on food, habitat alteration and agricultural chemicals. Pp. 79-87 in: Meyburg & Chancellor (1989).
- White, C.M., Pruett-Jones, S.C. & Emison, W.B. (1981). The status and distribution of the Peregrine Falcon in Victoria, Australia. *Emu* 80: 270-280.
- White, C.M., Parrish, J.R., Brimm, D.J. & Longmire, J.L. (1993). Aspects of variation between Peregrine Falcon populations: a review with emphasis on the Southern Hemisphere. In: Olsen (1993a).
- White, C.M.N. (1945). Three recently described game birds from Angola. *Ibis* 87: 466-467.
- White, C.M.N. (1965). *A Revised Check List of African Non-passerine Birds*. Government Printer, Lusaka.
- White, C.M.N. & Bruce, M.D. (1986). *The Birds of Wallacea (Sulawesi, the Moluccas and the Lesser Sunda Islands, Indonesia)*. BOU Check-list 7. British Ornithologists' Union, London.
- White, D.H., Seginak, J.T. & Simpson, R.C. (1990). Survival of Northern Bobwhites in Georgia: cropland use and pesticides. *Bull. Contam. & Toxic.* 44: 73-80.
- Whitehead, C.H.T. (1911). Notes on the birds of Schore, central India with special reference to migration. *J. Bombay Nat. Hist. Soc.* 21: 153-170.
- Whitehead, C.H.T. (1914). Some notes on the birds of the Kaghan Valley, Hazara, NWFP. *J. Bombay Nat. Hist. Soc.* 23: 104-109.
- Whitfield, A.K. & Blaber, S.J.M. (1978). Feeding ecology of piscivorous birds at Lake St Lucia, South Africa. Part 1. Diving birds. *Ostrich* 49: 185-198.
- Widén, P. (1984). Activity patterns and time budget in the Goshawk *Accipiter gentilis* in a boreal area in Sweden. *Ornis Fenn.* 61: 109-112.
- Widén, P. (1985). Breeding and movements of Goshawks in boreal forests in Sweden. *Holarctic Ecol.* 8: 273-279.
- Widén, P. (1987). Goshawk predation during winter, spring and summer in a boreal forest area of central Sweden. *Holarctic Ecol.* 10: 1-7.
- Widén, P. (1989). The hunting habitats of Goshawks *Accipiter gentilis* in boreal forests of central Sweden. *Ibis* 131: 205-213.
- Wiedenfeld, D.A., Schulenberg, T. & Robbins, M. (1985). Birds of a tropical deciduous forest in extreme northwestern Peru. Pp. 305-316 in: Buckley et al. (1985).
- Wiemeier, S.N., Bunck, C.M. & Krynsky, A.J. (1988). Organochlorine pesticides, polychlorinated biphenyls, and mercury in Osprey eggs, 1970-1979. *Arch. Environm. Contam. Toxicol.* 17: 767-787.
- Wiemeier, S.N., Lamont, T., Bunck, C., Sindelar, C., Gramlich, E., Fraser, J. & Byrd, M. (1984). Organochlorine pesticides, polychlorinated biphenyls, and mercury residues in Bald Eagle eggs (1969-79) and their relationships to shell thinning and reproduction. *Arch. Environm. Contam. Toxicol.* 13: 529-549.
- Wiemeier, S.N., Schmeling, S.K. & Anderson, A. (1987). Environmental pollutant and necropsy data for Ospreys from the eastern USA. *J. Wildl. Dis.* 23: 279-291.
- Wiesner, J., Bergmann, H.H., Klaus, S. & Müller, F. (1977). Siedlungslichte und Habitatstruktur des Haselhühners (*Bonasia bonasia*) in Waldgebieten von Białowieża (Polen). *J. Orn.* 118: 1-20.
- Wiggers, E.P. & Krize, K.J. (1991). Comparison of nesting habitat of coexisting Sharp-shinned and Cooper's Hawks in Missouri. *Wilson Bull.* 103: 568-577.
- Wiklund, C.G., Lundberg, U. & Hultine, E. (1992). Forest structure associated with Red-legged Grouse abundance. *Forest Ecol. Manage.* 49: 211-218.
- Wigley, T.B., Sweeney, J.M., Garner, M.E. & Melchers, M.A. (1986). Wild Turkey home ranges in the Ouachita Mountains. *J. Wildl. Manage.* 50(4): 540-544.
- Wiklund, C.G. (1982). Fieldfare (*Turdus pilaris*) breeding success in relation to colony size, nest position and association with Merlus (*Falco columbarius*). *Behav. Ecol. Sociobiol.* 11: 165-172.
- Wiklund, C.G. & Village, A. (1992). Sexual and seasonal variation in territorial behaviour of Kestrels, *Falco tinnunculus*. *Anim. Behav.* 43: 823-830.

- Wikman, M. (1975). Sex ratio of Finnish nestling Goshawks *Accipiter gentilis* (L.). A preliminary report. In: *XII Congresso da União Internacional dos Biólogos da Caça*.
- Wikramanayake, E.N. (1969). Some rare and vanishing birds of Ceylon. *Loris* 11: 374-6.
- Wilbur, S.R. (1973). The Red-shouldered Hawk in the western United States. *Western Birds* 4: 15-22.
- Wilbur, S.R. (1978). The California Condor, 1966-76: a look at its past and future. *North Amer. Fauna* 72.
- Wilbur, S.R. (1983). The status of vultures in Europe. In: Wilbur & Jackson (1983).
- Wilbur, S.R. & Jackson, J.A. eds. (1983). *Vulture Biology and Management*. University of California Press, Berkeley, Los Angeles & London.
- Wildash, P. (1968). *Birds of South Vietnam*. Charles E. Tuttle & Co., Rutland, Vermont & Tokyo.
- Wiles, G.J. & Conry, P.J. (1990). Terrestrial vertebrates of the Ngerukwid Islands Wildlife Preserve, Palau Islands. *Micronesia* 23: 41-66.
- Wiles, G.J., Beck, R.E. & Amerson, A.B. (1987). The Micronesian Megapode on Tinian, Mariana Islands. *Elepaio* 47: 1-3.
- Wiley, J.W. (1975). The nesting and reproductive success of Red-tailed Hawks and Red shouldered Hawks in Orange County, California. *Condor* 77: 133-139.
- Wiley, J.W. (1985). Status and conservation of forest raptors in the West Indies. Pp. 199-204 in: Newton & Chancellor (1985).
- Wiley, J.W. (1986a). Habitat changes and its effects on Puerto Rican raptors. Pp. 51-56 in: Chancellor & Meyburg (1986).
- Wiley, J.W. (1986b). Status and conservation of raptors in the West Indies. Pp. 57-70 in: Chancellor & Meyburg (1986).
- Wiley, J.W. & Wiley, B.N. (1981). Breeding season ecology and behavior of Ridgway's Hawk (*Buteo ridgwayi*). *Condor* 83(1): 132-151.
- Wiley, R.H. (1973). Territoriality and non-random mating in Sage Grouse. *Anim. Behav. Monogr.* 6: 85-169.
- Wiley, R.H. (1974). Evolution of social organization and life-history patterns among grouse (Aves: Tetraonidae). *Quart. Rev. Biol.* 49: 201-227.
- Wiley, R.H. (1978). The lek mating system of the Sage Grouse. *Scientific American* 238: 114-125.
- Wilkinson, R., Dutton, G. & Sheldon, B. (1991a). *The Avifauna of Barito Ulu, Central Borneo, with Additional Notes on the Mammals*. ICBP, Cambridge, UK.
- Wilkinson, R., Dutton, G. & Sheldon, B., Darjono & Yas Rusila Noor (1991b). *The Avifauna of Barito Ulu Region, Central Kalimantan*. *Kukila* 5(2): 99-116.
- Willard, D.E., Foster, M.S., Barrowclough, G.F., Dickerman, R.W., Cannell, P.F. & Coats, S.L. (1991). *The Birds of Cerro de la Neblina, Territorio Federal Amazonas, Venezuela*. Field Museum of Natural History.
- Willard, F.C. (1913). Late nesting of certain birds in Arizona. *Condor* 15: 227.
- Wille, F. (1979). Den grønlandske Havørn *Haliaeetus albicilla groenlandicus* fødevalg - metode og foreløbige resultater. *Dan. Orn. Foren. Tidsskr.* 73: 165-170.
- Wille, F. & Kamp, K. (1983). Food of the White-tailed eagle *Haliaeetus albicilla* in Greenland. *Holarctic Ecol.* 6(1): 81-88.
- Willebrand, T. (1982). Breeding and age in female Black Grouse *Tetrao tetrix*. *Ornis Scand.* 23: 29-32.
- Willebrand, T. (1988). *Demography and Ecology of a Black Grouse (Tetrao tetrix L.) population*. PhD thesis, Uppsala University, Uppsala, Sweden.
- Willebrand, T. (1992). Breeding and age in female Black Grouse *Tetrao tetrix*. *Ornis Scand.* 23: 29-32.
- Willgöts, J.F. (1963). *Harvørnen*. Vestlandske Naturvennforening, Bergen.
- Willgöts, J.F. (1984). [The White-tailed Eagle *Haliaeetus albicilla albicilla* (L.) in Norway]. *Vil rapport* 27: 81 pp. In Norwegian with English summary.
- Williams, C.H. & Williams, C.E. (1929). Some notes on the birds breeding round Quetta. *J. Bombay Nat. Hist. Soc.* 33: 598-613.
- Williams, G.A. (1981). The Merlin in Wales: breeding numbers, habitat and success. *British Birds* 74: 205-214.
- Williams, G.R. (1952). The California Quail in New Zealand. *J. Wildl. Manage.* 16: 460-483.
- Williams, H.W. (1969). Vocal behavior of adult California Quail. *Auk* 86: 631-659.
- Williams, J.B., Best, D. & Warford, C. (1980). Foraging ecology of ptarmigan at Meade River, Alaska. *Wilson Bull.* 92: 341-351.
- Williams, L.E. (1961). Notes on wing molt in the yearling Wild Turkey. *J. Wildl. Manage.* 25(4): 439-440.
- Williams, L.E. (1974). Flight attainment in Wild Turkeys. *J. Wildl. Manage.* 38(1): 151-152.
- Williams, L.E. (1981). *The Book of the Wild Turkey*. Winchester Press, Tulsa, Oklahoma, USA.
- Williams, M.D. (1980). First description of the eggs of the White-winged Guan, *Penelope albigenis*, with notes on its nest. *Auk* 97: 889-892.
- Williams, R.N. (1985). Relationship between Prairie Falcon nesting phenology, latitude and elevation. *J. Raptor Res.* 19: 139-142.
- Williamson, W.J.F. (1918). New or noteworthy bird records from Siam. *J. Nat. Soc. Siam* 3: 15-16.
- Willis, E.O. (1963). Is the Zone-tailed Hawk a mimic of the Turkey Vulture? *Condor* 65(2): 313-317.
- Willis, E.O. (1966). A prey capture by the Zone-tailed Hawk. *Condor* 68(1): 104-105.
- Willis, E.O. (1976). A possible reason for mimicry of a bird-eating hawk by an insect-eating kite. *Auk* 93(4): 841-842.
- Willis, E.O. (1979). The composition of avian communities in remanescent woodlots in southern Brazil. *Pap. Avuls. Dep. Zool. São Paulo* 33: 1-25.
- Willis, E.O. (1980). Ecological roles of migratory and resident birds on Barro Colorado Island, Panama. Pp. 205-225 in: Keast & Morton (1980).
- Willis, E.O. (1988). A hunting technique of the Black-and-white Hawk-eagle (*Spizastur melanoleucus*). *Wilson Bull.* 100(4): 672-675.
- Willis, E.O. & Oniki, Y. (1978). (Ant-following by birds). *Ann. Rev. Ecol. Syst.* 9: 243-263.
- Willis, E.O., Wechsler, D. & Stiles, F.G. (1983). Forest-falcons, hawks, and a pygmy-owl as ant followers. *Rev. Brasil. Biol.* 43(1): 23-28.
- Willoughby, E.J. & Cade, T.J. (1967). Breeding behavior of the American Kestrel. *Living Bird* 3: 75-96.
- Wilmsers, A.H. (1982). Kestrel use of nest boxes on reclaimed surface mines in West Virginia and Pennsylvania. MSc thesis, West Virginia University, Morgantown, West Virginia.
- Wilson, B.E., Coldren, C., Coldren, M., Chavez-Ramirez, F. & Archer, T. (1993). Behavior of a group of Zone-tailed Hawks. *J. Raptor Res.* 27(2): 127.
- Wilson, D.L. (1982). *Nesting Habitat of Lesser Prairie-chickens in Roosevelt and Lea Counties, New Mexico*. New Mexico State University, Las Cruces.
- Wilson, K.J. (1965). A note on the crop contents of two Crested Guineafowl *Guttera edouardi* (Hartlaub). *Ostrich* 36: 103-106.
- Wilson, R.T. (1982). Environmental changes in western Darfur, Sudan, over half a century and their effects on selected bird species. *Malmibus* 4: 15-26.
- Wilson, R.T. ed. (1993). *Birds and the African Environment: Proceedings of the VIII Pan-African Ornithological Congress*. Annales du Musée Royal de l'Afrique Centrale (Zoologie) 268.
- Wilson, R.T. & Wilson, M.P. (1983). Notes on a Grey Kestrel *Falco andostaeus* brood in central Mal. *Bull. Brit. Orn. Club* 103: 118-119.
- Wilson, S.C. & Whelan, R.J. (1993). Prey camouflage in Sugar Gliders and predatory response by the Variable Goshawk. In: Olsen (1993a).
- Witkowski, J. (1968). The distribution and abundance of the Hazel Hen in southern Poland in 1966. *Acta Zool. Cracov* 13: 264-276.
- Wing, L. (1946a). Drumming flight of Blue Grouse and courtship characters of the Tetraonidae. *Condor* 48: 154-157.
- Wing, L. (1946b). Seasonal movements of the Blue Grouse. *Trans. North Amer. Wildl. Nat. Resour. Conf.* 12: 504-509.
- Wing, L., Beer, J. & Tidman, W. (1944). Brood habits and growth of Blue Grouse. *Auk* 61: 426-440.
- Wink, M., Biebach, H., Feldmann, F., Scharlau, W., Swatschek, L., Wink, C. & Ristow, D. (1993). Contribution to the breeding biology of Eleonora's Falcon (*Falco eleonorae*). Pp. 59-77 in: Negenhoof & Clarke (1993).
- Wink, M., Ristow, D. & Wink, C. (1979). Biologie des Eleonorenfalken (*Falco eleonorae*). 3. Parasitenbefall während der Brutzeit und Jugendentwicklung. *J. Orn.* 120: 94-97.
- Wink, M., Scharlau, W. & Ristow, D. (1987). Population structure in a colony of Eleonora's Falcon (*Falco eleonorae*). Pp. 301-306 in: Baccetti & Spagnoli (1987).
- Wink, M., Wink, C. & Ristow, D. (1979). Biologie des Eleonorenfalken (*Falco eleonorae*). 2. Zur Nahrung des Geflügelphagogen (heiß-dunkel). *J. Orn.* 119: 421-428.
- Wink, M., Wink, C. & Ristow, D. (1980a). Biologie des Eleonorenfalken (*Falco eleonorae*) 8. Die Gelegenheitsgröße im Verhältnis zum Nahrungsangebot. *J. Orn.* 121: 387-390.
- Wink, M., Wink, C. & Ristow, D. (1980b). Biologie des Eleonorenfalken (*Falco eleonorae*) 9. Elterntemperaturen und Körpertemperatur juveniler und adulter Falken während der Brutzeit. *Vogelwarte* 30: 320-325.
- Wink, M., Wink, C. & Ristow, D. (1982a). Biologie des Eleonorenfalken (*Falco eleonorae*). 10. Der Einfluss der Horstlage auf den Bruterfolg. *J. Orn.* 123: 401-408.
- Wink, M., Wink, C. & Ristow, D. (1982b). Biologie des Eleonorenfalken (*Falco eleonorae*). 12. Biometrie des Sexualdimorphismus adulter und flugger Falken. *Die Vogelwelt* 15: 225-229.
- Winn, B. (1992). Captive breeding of the Makso *Micromorphodon makso*. *Megapode News* 6(1): 3-5.
- Wise, D.R. (1982). Nutrition of wild Red Grouse (*Lagopus lagopus scoticus*). *J. World Pheasant Assoc.* 7: 36-41.
- Wise, D.R. & Fuller, M.K. (1978). Artificial insemination in the Brown Eared-pheasant *Crossoptilon manchuricum*. *J. World Pheasant Assoc.* 3: 90-95.
- Witkowski, J. (1989). Breeding biology and ecology of the Marsh Harrier *Circus aeruginosus* in the Buryer valley, Poland. *Acta Orn. Zool.* 25: 223-320.
- Wittenberger, J.F. (1973). The evolution of mating systems in grouse. *Condor* 80: 126-137.
- Woehr, J.R. (1974). *Water and Spring Shelter and Food Selection by Ruffed Grouse in central New York*. MSc thesis, State University of New York.
- Woolfenden, J.E. (1975). *Ecology of the Ferruginous Hawk (Buteo regulus) in Central Utah: Population Dynamics and Nest Site Selection*. PhD thesis, Brigham Young University, Provo, Utah.
- Woolfenden, J.E. (1986). Notes on the Swainson's Hawk in central Utah: insectivory, prey specialization, parasitism, and kleptoparasitism. *Great Basin Nat.* 46: 302-304.
- Woolfenden, N.D. & Murphy, J.R. (1977). Population dynamics of the Ferruginous Hawk during a prey decline. *Great Basin Nat.* 37: 411-425.
- Woolfenden, N.D. & Murphy, J.R. (1983). Ferruginous Hawk nest site selection. *J. Wildl. Manage.* 47: 216-219.
- Woolfenden, N.D. & Murphy, J.R. (1989). Decline of a Ferruginous Hawk population: a 20-year summary. *J. Wildl. Manage.* 53: 1127-1132.
- Woinarski, J.C.Z. (1989). The vertebrate fauna of broombush *Melaleuca uncinata* vegetation in north-western Victoria, with reference in effects of broombush harvesting. *Aust. Wildl. Res.* 16: 217-238.
- Wolf, D.E. (1984). Ayres' Hawk Eagle *Hieraeetus dubius* feeding on a fruit bat. *Scopus* 8: 44.
- Wolfe, L.R. (1938). Birds of central Luzon. *Auk* 55: 202.
- Wolfe, L.R. (1951). Eggs of the Falconiformes. Part 3. *Oologist's Record* 25: 49-54.
- Wolfe, L.R. (1954). Nesting of the Laughing Falcon. *Condor* 56(3): 161-162.
- Wolff, S. (1976). Egg-dumping by the Helmeted Guineafowl *Bonasaerina* 28: 97-98.
- Wolff, T. (1965). Volcanic heat incubation in *Megapodius javanicus* *crematus*. *Harl. Dan. Orn. Foren. Tidsskr.* 59: 74-84.
- Wood, B. (1987). Hunting technique of the African Goshawk *Accipiter taylori* and its possible relationship with other Accipiter species. *Scopus* 11: 6-8.
- Wood, K.N., Guthery, F.S. & Koerth, N.E. (1986). Spring-summer nutrition and condition of Northern Bobwhites in south Texas. *J. Wildl. Manage.* 50: 84-88.
- Wood, P.B., Nesbitt, S.A. & Steffer, A. (1993). Bald Eagles prey on Sandhill Cranes in Florida. *J. Raptor Res.* 27: 164-165.
- Woodall, P.F. (1971). Bird notes from northern Sengwa Gorge, Rhodesia. *Ostrich* 42: 148-149.
- Woodin, N. (1980). Observations on Gyrfalcons (*Falco rusticolus*) breeding near Lake Myvatn, Iceland, 1967. *J. Raptor Res.* 14: 97-124.
- Woods, R.W. (1988). *Guide to Birds of the Falkland Islands*. Anthony Nelson, Oswestry, UK.
- Woodsman, R.B. (1912). New localities for Hubbard's Francolin. *J. East Afr. & Uganda Nat. Hist. Soc.* 4: 135.
- Wootton, J.T. & Bell, D.A. (1992). A metapopulation model for the Peregrine Falcon in California: viability and management strategies. *Ecol. Applications* 2: 307-321.
- Worden, C. (1985). Possible breeding of the Red-necked Falcon in Zimbabwe. *Honeyguide* 31: 217.
- Work, T.H. & Wool, A.S. (1942). The nest life of the Turkey Vulture. *Condor* 44: 149-150.
- Wotzkow, C. (1986a). Status and distribution of Falconiformes in Cuba. Pp. 1-10 in: Chancellor & Meyburg (1986).
- Wotzkow, C. (1986b). Ecological observations of Gundlach's Hawk *Accipiter gundlachi* in Cuba. Pp. 111-114 in: Chancellor & Meyburg (1986).
- Wotzkow, C. (1991). New subspecies of Gundlach's Hawk, *Accipiter gundlachi*. Pp. 271-281 in: Chancellor & Meyburg (1991).
- Wrege, P. & Cade, T.J. (1977). Courtship behavior of the large falcons in captivity. *J. Raptor Res.* 11: 1-27.
- Wu Ming-chuan (1988a). Distribution and breeding ecology of Fukiang Tragopan *Tragopan caboti quannensis*. *Guangxi Forestry* 6: 33-34.
- Wu Ming-chuan (1988b). The ecology of the Silver Pheasant *Lophura nycthemera* and its distribution in Guangxi. *Guangxi Forestry* 4(4): 19-20.
- Wu Ming-chuan (1989). Distribution of the subspecies of the Fukiang Tragopan *Tragopan caboti* in Guangxi Province and its reproductive ecology. *Chinese Wildlife* 5: 11, 17-18.
- Wu Zhi-kang (1979a). Feeding habits of the Ring-necked Pheasant. *Chinese J. Zool.* 2: 28-29.
- Wu Zhi-kang (1979b). On the ecology of the Reeves' Pheasant. *Chinese J. Zool.* 3: 16-17.
- Wu Zhi-kang (1980). Observation on the ecology of the Golden Pheasant. *Chinese Wildlife* 7: 26-28.
- Wu Zhi-kang & Hsu Wei-shu (1986). The distribution and abundance of White-crowned Long-tailed Pheasants *Symyticus reevesii* in Guizhou Province, China. In: Ridley (1986a).
- Wu Zhi-kang & Xu Wei-shu (1987). On the geographical distribution and abundance of the White-crowned Long-tailed Pheasant *Symyticus reevesii* in Guizhou Province. *Zool. Res.* 8(1): 13-19.
- Wu Zhi-kang, Li Z.-m., Yu Z.-g. & Jang, H. (1993). Study of the Reeves' Pheasant in Touda Forest, Guizhou, China. *World Pheasant Assoc. News* 39: 7-11.
- Wunderlich, K. (1980). Zum Nahrungsspektrum freilebender Riesenseeadler, *Haliaeetus pelagicus* (Pallus), im Fernen Osten. *Mit. S.* 130-132.
- Wurz, G.A. (1971). Tolerance of Wild Turkeys to human disturbance and limited range. *Proc. Annual Conference of Northeast Association of Game and Fish Commissioners* 28: 46-57.
- van Wyk, E., van der Bank, F.H. & Verdoorn, G.H. (1993). Chlorinated hydrocarbon insecticide residues in the Cape Griffon Vulture *Gyps coprotheres*. *Comp. Biochem. Physiol. C: Comp. Pharmacol. Toxicol.* 104: 209-220.
- Wyllie, I. (1985). Post-fledging period and dispersal of young Sparrowhawks. *Bird Study* 32: 749-766.
- Wyrwoll, T. (1977). Die Jagdbereitschaft des Habichts (*Accipiter gentilis*) in Beziehung zum Horstort. *J. Orn.* 118: 21-34.
- Xu Wei-shu, Wu Zhi-kang & Li Z.-m. (1990). Current status of the Reeves' or White-crowned Long-tailed Pheasant in China. Pp. 31-32 in: Hill et al. (1990).
- Yahya, H.S.A. (1993a). Habitat preference in Monal Pheasants. Pp. 146-147 in: Jenkins (1993).
- Yahya, H.S.A. (1993b). Adaptive significance of vocalization in the Krokass Pheasant. In: Jenkins (1993).
- Yalder, D.W. & Warburton, A.B. (1979). The diet of the Kestrel in the Lake District. *Bird Study* 26: 163-170.
- Yamashina, Y. (1939). Note sur le tétras failepenné de Sibirie. *Oiseau et R. O. N.* 3-9.
- Yamashina, Y. (1976). Notes on the Japanese Copper Pheasant. *J. World Pheasant Assoc.* 1: 23-42.
- Yan An-huo (1990). Ecological habits of the Chinese Ring-necked Pheasant. Page 82 in: Hill et al. (1990).
- Yan Li (1984). Distribution of the Cabot's Tragopan in the Jinggangshan Mountain. *Chinese Wildlife* 20: 24-25.
- Yang Jiong-li, Wu Zhi-kang et al. (1981). Preliminary observations on the breeding behaviour and feeding habits of the Chinese Copper Pheasant *Chrysolophus amherstiae*. *Zool. Res.* 2(3): 243-246.
- Yang Lan & Li Zhi-xiang (1984). Breeding ecology of the Blood Pheasant *Tharpornis erythrogastrus* in Biluo Snow Mountain, Yunnan Province. *Chinese Wildlife* 22(6): 19-20.
- Yang Lan & Yu Yan-ping (1987). A new subspecies of Tibetan Snowcock *Tetrao tibetanus tibetanus* *amurensis* (Galliformes: Phasianidae). *Acta Zootaxonomica Sinica* 12(4): 104-109.
- Yang X.-m. (1985). The Fukiang Tragopan *Tragopan caboti*. *China Chinese Wildlife* 3: 2.
- Yang X.-m. (1990). The ecology of the Dauman Partridge. Page 38 in: Hill et al. (1990).
- Yang Xiaojun, Zhou Jianpin & Yang Lan (1991). (An observation of feeding behaviour of the Bamboo Partridge in captivity). *Zool. Res.* 12(3): 259-264. In Chinese with English summary.
- Yáñez, J.L., Núñez, H., Schlatter, R.P. & Jaksic, F.M. (1980). Diet and weight of American Kestrels in central Chile. *Auk* 97: 629-631.
- Yáñez, J.L., Núñez, H. & Jaksic, F.M. (1982). Food habits and weight of Chimango Caracaras in central Chile. *Auk* 99(1): 170-171.
- Yao Ming-shu (1989). The Blood Pheasant *Tharpornis erythrogastrus* of Ta-hsi Mountain, Shensi Province, China. *J. Zool.* 6: 32-36.
- Ye Xiao-ti (1991). Distribution and status of the Cinnereous Vulture *Aegypius monachus* in China. Pp. 51-56 in: Chancellor & Meyburg (1991).
- Yeutter, R.E. (1943). The Prairie Chicken in Illinois. *Illinois Nat. Hist. Survey Bull.* 22: 377-416.
- Yeutter, R.E. (1963). Population responses of Prairie Chickens to land-use changes in Illinois. *J. Wildl. Manage.* 27: 739-757.
- Yomtov, D. (1991). *Raptors in Israel: Population and Management*. Tel-Aviv University, Tel-Aviv, Israel.
- Yin (1970). Record of the Himalayan Monal *Lophophorus impeyanus* (Latham) in Burma. *J. Bombay Nat. Hist. Soc.* 67: 328-330.
- Yomtov, F. & Harris, S.W. (1985). The food habits of Mountain Quail *Oreortyx pictus* in northwestern Washington. *J. Wildl. Manage.* 17: 204-207.
- Yong, D. (1990). Recent information on the Sula Scrubfowl *Megapodius bernieri*. *Megapode News* 4(1): 3-5.

- Yonzon, P.B. (1987). Nepal-Himalaya pheasant surveys at Pipar, Machhapuchare. Pp. 55-57 in: Savage & Ridley (1987).
- Yonzon, P.B. & Lelliot, A.D. (1980). Pheasant studies in the Annapurna Himal II. Human interference in ecosystems. Pp. 56-62 in: Savage (1980).
- Yosef, R. (1991). Foraging habits, hunting and breeding success of Lanner Falcons (*Falco biarmicus*) in Israel. *J. Raptor Res.* 25: 77-81.
- Young, C.G. (1925). Notes on the nests and eggs of some British Guiana birds. *Ibis* Ser. 12: 465-475.
- Young, H. (1973). Breeding of a pair of Wedge-tailed Eagles. *Austr. Bird Watcher* 5: 99-101.
- Young, J.G. (1973). Social nesting and polygamy in Kestrels and Sparrowhawks. *British Birds* 66: 32-33.
- Young, L. & Hussain, M. (1990). Chick-rearing methods for pheasant reintroductions. Pp. 261-264 in: Hill *et al.* (1990).
- Young, L., Garson, P.J. & Kaul, R. (1987). Calling behaviour and social organisation in the Cheer Pheasant: implications for survey technique. *J. World Pheasant Assoc.* 12: 30-43.
- Young, L., Zheng Guang-mei & Zhang Zheng-wang (1991). Winter movement and habitat use by Cabot's Tragopan *Tragopan caboti* in southeastern China. *Ibis* 133: 121-126.
- Ytreberg, N.J. (1992). [White-tailed Eagle *Haliaeetus albicilla* hunting in a Grey Heron *Ardea cinerea* colony in Sunnmore, Norway]. *Fauna Norvegica (Ser. C. Cinclus)* 15(1): 25-30. In Norwegian with English summary.
- Zacharias, V.J. & Gaston, A.J. (1993). The birds of Wynaad, southern India. *Forktail* 8: 11-23.
- Zarr, M. (1979). *Oxyptor Pandion haliaetus carolinensis*. US Department of the Interior.
- Zastros, M. (1946). On the distribution and biology of the Golden Eagle in Estonia. *Vôr Fågelsvärld* 5: 64-80.
- Zhinden, N. (1979). Zur Ökologie des Haselhuhns *Bonasa bonasia* in den Buchenwäldern des Chasseral, Fallenjura. *Örn. Beob.* 76: 169-214.
- Zhinden, N. (1980). Zum Verdaulichkeit und umsetzbaren Energie von Tetraoniden-Winter-Nahrung und zum Erhaltungsbedarf des Birkhuhnes (*Tetrao tetrix*) im Gefangenschaft mit Hinweisen auf Verdauungsversuche. [Summary: On the digestibility and metabolizable energy of tetraonid winter food and on the energy requirements for maintenance of Black Grouse *Tetrao tetrix* in captivity, with remarks on digestibility trials]. *Vogelwelt* 101: 1-18. In German with English summary.
- Zhinden, N. (1985). Zum Verbreitung, Siedlungsdichte und Balzgruppen-grösse des Birkhuhns *Tetrao tetrix* im Tessin. *Örn. Beob.* 82: 107-115.
- Zhinden, N. (1987). Zum Aufzuchtserfolg des Birkhuhns *Tetrao tetrix* im Tessin. *Örn. Beob.* 84: 49-61.
- Zeliang, D.K. (1980). Blyth's Tragopan breeding centre, Kohima, Nagaland. Pp. 88-91 in Savage (1980).
- Zeliang, D.K. (1987). New measures to protect the pheasants of Nagaland. Pp. 87-89 in: Savage & Ridley (1987).
- Zeng Yang-zhi & He Fen-qi (1990). Chromosome polymorphism in the Common Quail. Page 87 in: Hill *et al.* (1990).
- Zepeda, G. (1981). La situación actual de los crácidos en Guatemala. Pp. 111-115 in: Estudillo López (1981).
- Zettel, J. (1974). Nahrungsökologische Untersuchungen am Birkhuhn *Tetrao tetrix* in den Schweizer Alpen. *Örn. Beob.* 71: 186-246.
- Zheng Jun-ping & Zheng Guang-mei (1990). Numbers and population structure of Cabot's Tragopan. Pp. 39-42 in: Hill *et al.* (1990).
- Zheng Jun, Liu Huan-jin *et al.* (1983). A method of census of the Brown Eared-pheasant *Crossoptilon mantchuricum*. *Wildlife* 2: 34-35.
- Zhang Xiao-ai (1984). Measurements of growth, development and daily energy of Upland Buzzard *Buteo hemilasius* nestlings. *Zool. Res.* 5(4): 369-376.
- Zhang Xiu-xiang (1983). Luya Mountain (Shanxi Province): the home of the Brown Eared-pheasant *Crossoptilon mantchuricum*. *Wildlife* 2: 10-12.
- Zhang Yin-sun (1959). The Blue Eared-pheasant *Crossoptilon auritum*. *Chinese J. Zool.* 3(3): 105-106, 109.
- Zhang Yin-sun, Liang Shuan-zhu *et al.* (1989). A new subspecies of the Chukor Partridge *Alectoris chukar* *andersonis* (Galliformes: Phasianidae). *Acta Zootaxonomica Sinica* 14(4): 496-499.
- Zhang Zheng-wang (1989). The breeding performance of White Eared-pheasants in captivity at Jersey Wildlife Preservation Trust. *J. World Pheasant Assoc.* 14: 43-58.
- Zhang Zheng-wang & Wu Yie-ching (1992). The Daurian Partridge *Perdix dauurica* in north-central China. Pp. 591-595 in Birkan, Potts *et al.* (1992).
- Zhang Zheng-wang & Zheng Guang-mei (1990). Nest site selection and nest losses of Cabot's Tragopan in Wuyangin Natural Reserve, China. Pp. 49-53 in: Hill *et al.* (1990).
- Zhang Zheng-wang, Niu Feng-li, Sun Qing-an & Robertson, P.A. (1993). Ecology of the Chinese Ring-necked Pheasant. Pp. 91-94 in: Jenkins (1993).
- Zhao Xin-ru, Ding Chang-qin, Zheng Guang-mei & Li Fu-lai (1990). The breeding of Cabot's Tragopan in captivity. Pp. 54-58 in Hill *et al.* (1990).
- Zhao Xuan (1956). Ecology and rearing of the Golden Pheasant *Chrysolophus pictus*. *Bull. Biol.* 10: 29-31.
- Zhao Zhen-jie (1990). The breeding ecology of Ring-necked Pheasants. Page 80-81 in: Hill *et al.* (1990).
- Zhao Zhen-jie, Wu Jingcai & Zhang Shuhua (1992). A traditional method for hunting the Daurian Partridge (*Perdix dauurica sutchkini*) in China. Pp. 831-835 in: Birkan, Potts *et al.* (1992).
- Zhao Zhen-jie, Zhang Shuhua & Feng Kai Feng (1992). The biology of the Daurian Partridge (*Perdix dauurica*) in north-eastern China. Pp. 597-604 in: Birkan, Potts *et al.* (1992).
- Zheng Guang-mei (1985). On the breeding ecology of *Tragopan caboti*. *Acta. Ecol. Sinica* 5: 379-385.
- Zheng Guang-mei (1986a). The breeding ecology of Cabot's Tragopan. In: Ridley (1986a).
- Zheng Guang-mei (1986b). A special local rare bird in our country, the Fukien Tragopan *Tragopan caboti*. *Chinese Wildlife* 4: 28.
- Zheng Guang-mei (1987). The Yellow-billed Tragopan *Tragopan caboti*. *Chinese J. Zool.* 5: 40-43.
- Zheng Guang-mei (1988). A review of the biological studies of the Phasianidae in China. *J. World Pheasant Assoc.* 13: 13-20.
- Zheng Guang-mei & Zhang Zheng-wang (1993). The distribution and status of pheasants in China. Pp. 15-19 in: Jenkins (1993).
- Zheng Guang-mei, Yin Rong-lun *et al.* (1989a). Courtship display behaviour of Cabot's Tragopans *Tragopan caboti*. *Acta Zoologica Sinica* 35(3): 328-332.
- Zheng Guang-mei, Yin Rong-lun *et al.* (1989b). Feeding activity of captive Cabot's Tragopans *Tragopan caboti* during the breeding season. *Zool. Res.* 10(4): 333-339.
- Zheng Guang-mei, Zhang Zheng-wang *et al.* (1986). The breeding of the Fukien Tragopan *Tragopan caboti* in captivity and the growth and development of its young. *Chinese Wildlife* 6: 39-43.
- Zheng Guang-mei, Zhang Zheng-wang, Young, L., Qian F.-w. & Sun Yue-hua (1990). The use of radiotelemetry to study Cabot's Tragopan in Wuyangin Natural Reserve, China. Pp. 43-48 in Hill *et al.* (1990).
- Zheng Guang-mei, Zhao Xin-ru, Song Jie, Liu Zongxing & Zhou Hong-qing (1985). [On the breeding ecology of the Fukien Tragopan *Tragopan caboti*]. *Acta Ecol. Sinica* 5(4): 379-385. In Chinese.
- Zheng Guang-mei, Zhao Xin-ru, Song Jie, Liu Zongxing & Zhou Hong-qing (1986). [Feeding ecology of the Fukien Tragopan *Tragopan caboti*]. *Acta Ecol. Sinica* 6(3): 283-288. In Chinese.
- Zheng He-xun & Chen Fu-guan (1987). Population ecology of the Blood Pheasant *Ithaginis cruentus* in Qinling (Shaanxi Province). *J. Northwest University (Natural Science Edition)* 17(4): 93-98.
- Zheng Sheng-wu & Liao Yan-fa (1983). Studies on habits, activities, food and reproduction of the Blue Eared-pheasant *Crossoptilon auritum*. *Acta Zool. Sinica* 29(1): 71-85.
- Zheng Sheng-wu & Pi Nan-lin (1979). Preliminary observations on the ecology of the Tibetan Snowcock *Tetraogallus tibetanus*. *Chinese J. Zool.* (1): 24-29.
- Zheng Zuo-xin & Wu Ming-chuan (1979). A new subspecies of Fukien Tragopan *Tragopan caboti guangxiensis*. *Acta Zool. Sinica* 25(3): 292-294.
- Zhezhurin, V.P. (1969). [On taxonomic interrelations of *Aquila clanga* and *Aquila pomarina*]. *Zhurn. prats. zool. mus.* 33: 91-97. In Ukrainian.
- Zieren, M. (1985). Maleo Birds *Macrocephalon maleo* in the Dumoga-Bone National Park. An analysis of the habitat suitability of nesting grounds. Mimeographed report, Agricult. University Wageningen.
- Ziesemer, F. (1983). *Hiersuchungen zum Einfluss des Habitats (Accipiter gentilis) auf Populationen seinen Beutetiere*. Verlag Günter Hartmann, Kronshagen.
- Zimmer, J.T. & Osgood, W.H. (1930). *Birds of the Marshall Field Peruvian Expedition, 1922-1923*. Field Museum of Natural History, Chicago.
- Zimmer, J.T. & Phelps, W.H. (1954). A new flycatcher from Venezuela, with remarks on the Mocquerys Collection and the Piculet, *Picumnus squamulatus*. *Amer. Mus. Novit.* 1657(25): 1-7.
- Zimmerman, D.A. (1965). The Gray Hawk in the southwest. *Audubon Field Notes* 19: 475-477.
- Zimmerman, D.A. (1970). An earlier nesting record of *Circus fasciatus* in Kenya. *Ibis* 112: 264.
- Zimmerman, D.A. (1976a). Comments on feeding habits and vulture-mimicry in the Zone-tailed Hawk. *Condor* 78(3): 420-421.
- Zimmerman, D.A. (1976b). On the status of *Buteo nitidus* in New Mexico. *Auk* 93(3): 650-655.
- Zimmerman, D.A. & Harry, G.B. (1951). Summer birds of Aulian Jalisco. *Wilson Bull.* 63: 302-314.
- Zink, R.M., Lott, D.F. & Anderson, D.W. (1987). Genetic variation, population structure, and evolution of California Quail. *Condor* 89: 395-405.
- Ziswiler, V. (1970). Die Bedrohung der Landvogelfauna südwest-pazifischer Inseln. *Zool. Mus. Univ. Zurich*. Project 391: 1-8. Report to WWF.
- Zollinger, R. & Hagemeier, W.J.M. (1994). The Lesser Kestrel *Falco naumanni*: review of the status of a globally threatened species. In: Meyburg & Chancellor (1994a).
- Zonfrillo, B. (1977). Re-discovery of the Andean Condor *Vultur gryphus* in Venezuela. *Bull. Brit. Orn. Club* 97: 17-18.
- Zorig, G. & Bold, A. (1983). Breeding biology of the Altai Snowcock. *Ornitologia* 18: 109-111.
- Zotta, A. (1931). Notas sobre dos rapaces migratorias (*Buteo swainsoni* y *Tachytrorchiis albicaudatus*). *Hornero* 4: 421-424.
- Zou Zhao-fen (1986). The karyotype of the Chinese Monal, *Lophophorus lhuysii* (Aves: Phasianidae). *Sinozoologia* 4: 37-40.
- Zuk, M., Johnson, K., Thornhill, R. & Ligon, D.L. (1990a). Parasites and male ornaments in free-ranging and captive Red Junglefowl. *Behaviour* 114: 232-248.
- Zuk, M., Johnson, K., Thornhill, R. & Ligon, D.L. (1990b). Mechanisms of female choice in Red Junglefowl. *Evolution* 44: 477-485.
- Zuk, M., Thornhill, R., Ligon, D.L., Johnson, K., Ligon, S.H., Thornhill, N.W. & Costin, C. (1990). The role of ornaments and courtship behavior in female mate choice of Red Junglefowl. *Amer. Naturalist* 136: 459-473.
- Zukowsky, L. (1966). Meine Begegnungen mit dem Schwarzen Seeadler, *Haliaeetus pelagicus niger* Heude, von Korea. *Zool. Garten NF* 32: 54-59.
- Zverev, M.D. (1962). [On the ecology of the Black Grouse in Tien-Shan (Trans-Ili-Alatau)]. *Ornitologia* 5: 208-211.
- Zwank, P.J., White, T.H. & Kimmel, F.G. (1988). Female Turkey habitat use in Mississippi river bature. *J. Wildl. Manage.* 52(2): 253-260.
- Zwart, P. (1982). Mites in the subcutis of tragopan pheasants (*Tragopan temminckii* and *T. satyra*). *J. World Pheasant Assoc.* 7: 67-69.
- Zwart, P. & Louwman, J.W.W. (1980). Feeding a hand-reared Andean Condor and King Vulture. *Vultur gryphus* and *Sarcornamphus papa*, at Wassenaar Zoo. *Int. Zoo Yb.* 20: 276-277.
- Zwickel, F.C. (1965). *Early Mortality and the Numbers of Blue Grouse*. PhD thesis, University of British Columbia, Vancouver.
- Zwickel, F.C. (1967a). Early behavior in young Blue Grouse. *Murrelet* 48: 2-7.
- Zwickel, F.C. (1967b). Some observations of weather and brood behavior in Blue Grouse. *J. Wildl. Manage.* 31: 563-568.
- Zwickel, F.C. (1972). Removal and repopulation of Blue Grouse in an increasing population. *J. Wildl. Manage.* 36: 1141-1152.
- Zwickel, F.C. (1973). Dispersion of female Blue Grouse during the brood season. *Condor* 75: 114-119.
- Zwickel, F.C. (1975). Nesting parameters of Blue Grouse and their relevance to populations. *Condor* 77: 423-430.
- Zwickel, F.C. (1977). Local variations in the time of breeding of female Blue Grouse. *Condor* 79: 185-191.
- Zwickel, F.C. (1983). Factors affecting the return of young Blue Grouse to their breeding range. *Can. J. Zool.* 61: 1128-1132.
- Zwickel, F.C. (1986). Winter food habits of Capercaillie in north-east Scotland. *British Birds* 59: 325-336.
- Zwickel, F.C. (1992). *Blue Grouse*. No. 15 in: Poole *et al.* (1992).
- Zwickel, F.C. & Bendell, J.F. (1967). Early mortality and the regulation of numbers in Blue Grouse. *Can. J. Zool.* 45: 817-851.
- Zwickel, F.C. & Bendell, J.F. (1972). Blue Grouse, habitat and populations. Pp. 150-169 in: *Proc. XV Int. Orn. Congr. the Hague, 1970*.
- Zwickel, F.C. & Bendell, J.F. (1986). Variations in the winter diet of Blue Grouse. *J. World Pheasant Assoc.* (1985/86): 44-52.
- Zwickel, F.C. & Brigham, J.H. (1970). Autumn sex and age ratios of Spruce Grouse in north-central Washington. *J. Wildl. Manage.* 34: 218-219.
- Zwickel, F.C. & Brigham, J.H. (1974). Autumn weights of Spruce Grouse in north-central Washington. *J. Wildl. Manage.* 38: 315-319.
- Zwickel, F.C. & Dake, J.A. (1977). Primary molt of Blue Grouse (*Dendragapus obscurus*) and its relation to reproductive activity and migration. *Can. J. Zool.* 55: 1782-1787.
- Zwickel, F.C. & Lance, A.N. (1965). Renesting in Blue Grouse. *J. Wildl. Manage.* 29: 402-404.
- Zwickel, F.C. & Lance, A.N. (1966). Determining the age of young Blue Grouse. *J. Wildl. Manage.* 30: 712-717.
- Zwickel, F.C., Boag, D.A. & Bendell, J.F. (1989). Longevity in Blue Grouse. *North Amer. Bird Bander* 14: 1-4.
- Zwickel, F.C., Brigham, J.H. & Buss, I.O. (1975). Autumn structure of Blue Grouse populations in north-central Washington. *J. Wildl. Manage.* 39: 461-467.
- Zwickel, F.C., Buss, I.O. & Brigham, J.H. (1968). Autumn movements of Blue Grouse and their relevance to populations and management. *J. Wildl. Manage.* 32: 456-468.
- Zwickel, F.C., Degner, M.A., McKinnon, D.T. & Boag, D.A. (1991). Sexual and subspecific variations in the numbers of reticines of Blue Grouse. *Can. J. Zool.* 69: 134-140.
- Zwickel, F.C., Lewis, R.A. & McKinnon, D.Y. (1988). Nesting parameters in a high density, declining population of Blue Grouse. *Can. J. Zool.* 66: 1736-1741.
- Zykova, L.J. (1965). [Tetraonid densities in 12 areas of European Russia, after linear counts in winter]. *Trudy Oskogo gos. zapovednika* 6: 353-372.
- van Zyl, A.J. (1991). Unusual falcon hunting behaviour. *Gabarr* 6: 68.
- van Zyl, A.J. & Cooke, J. (1987). Observations on the breeding of the Redbreasted Sparrowhawk. *Bee-eater* 38: 25-26.

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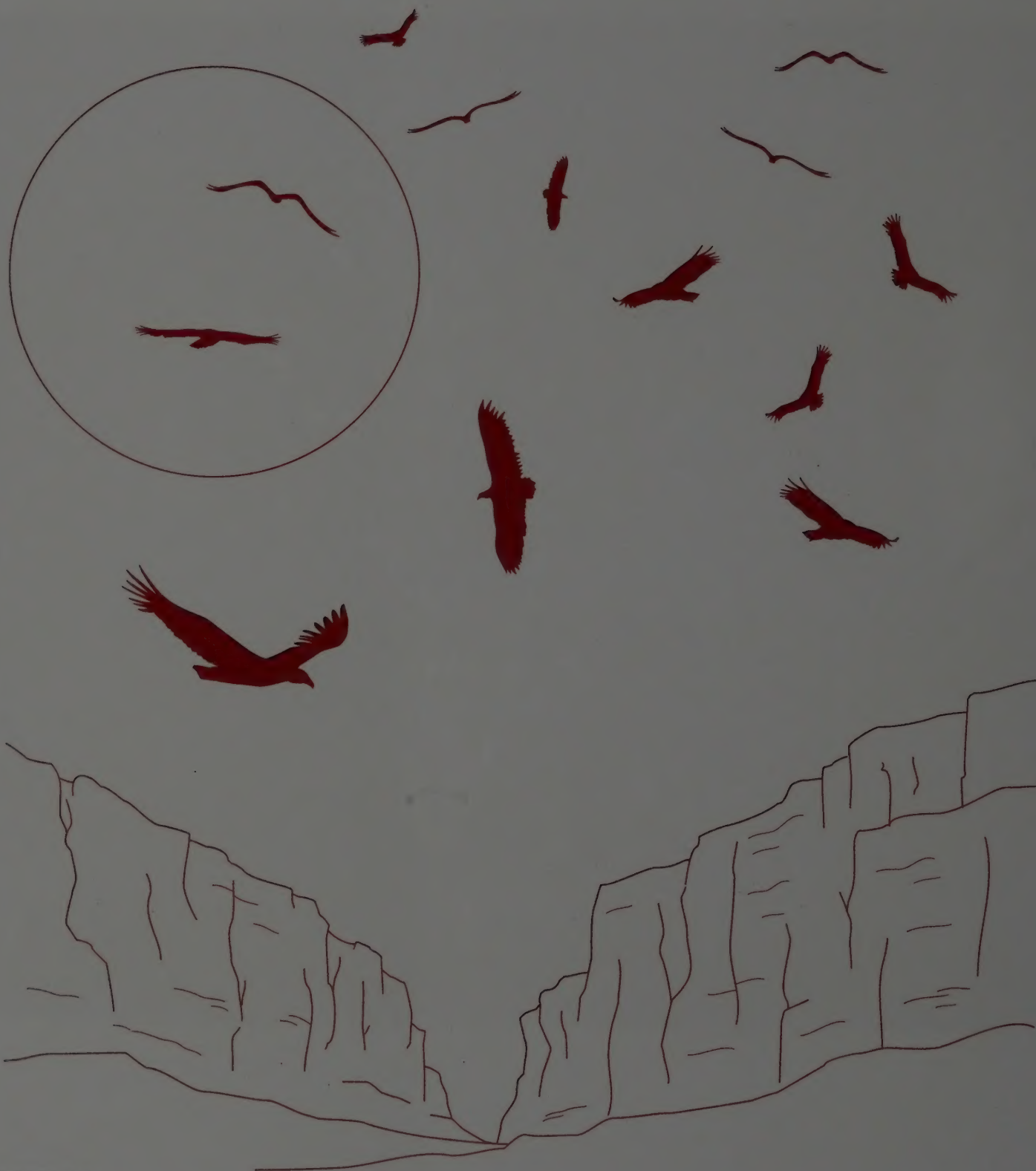
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